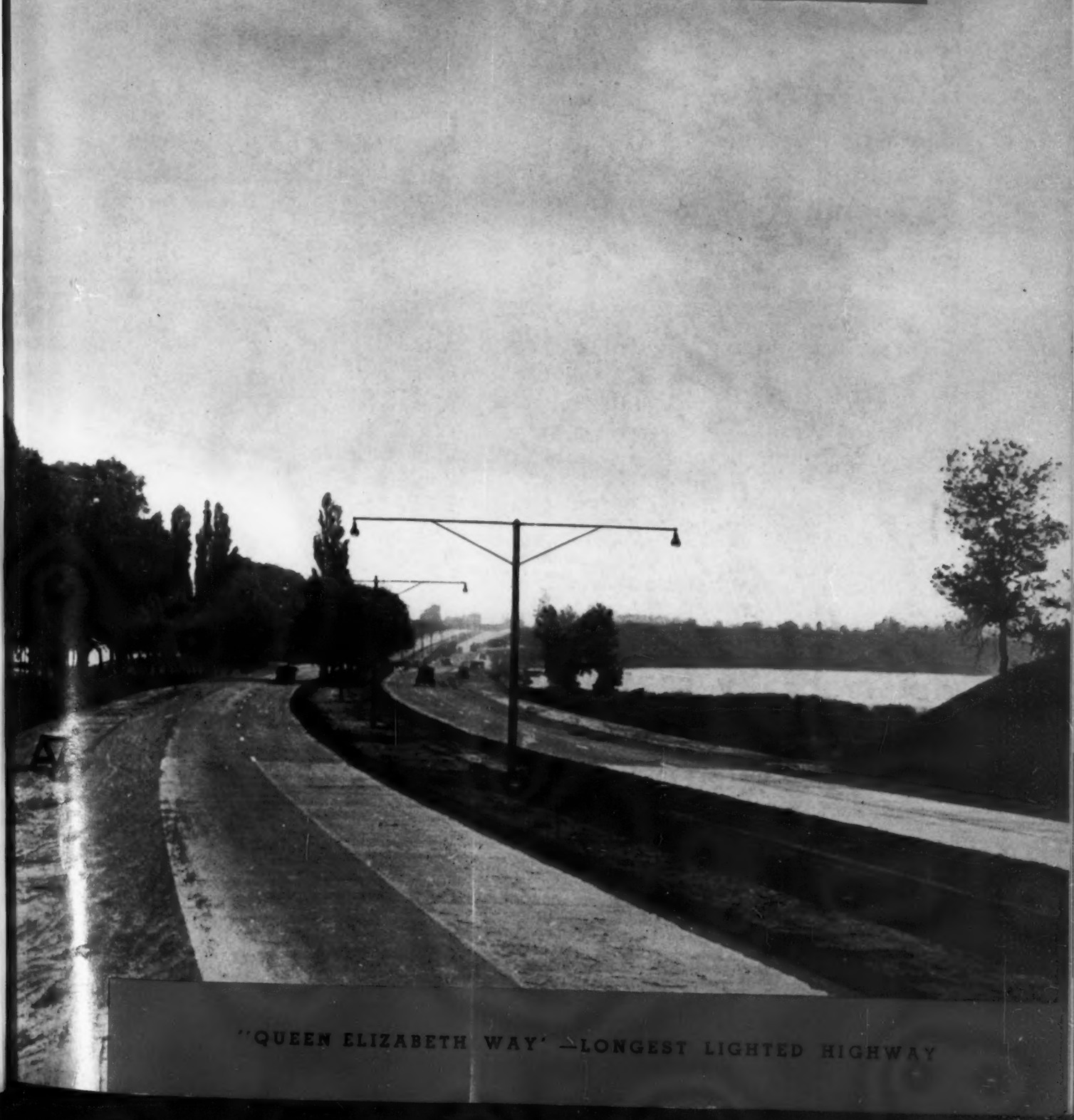
Electrical World

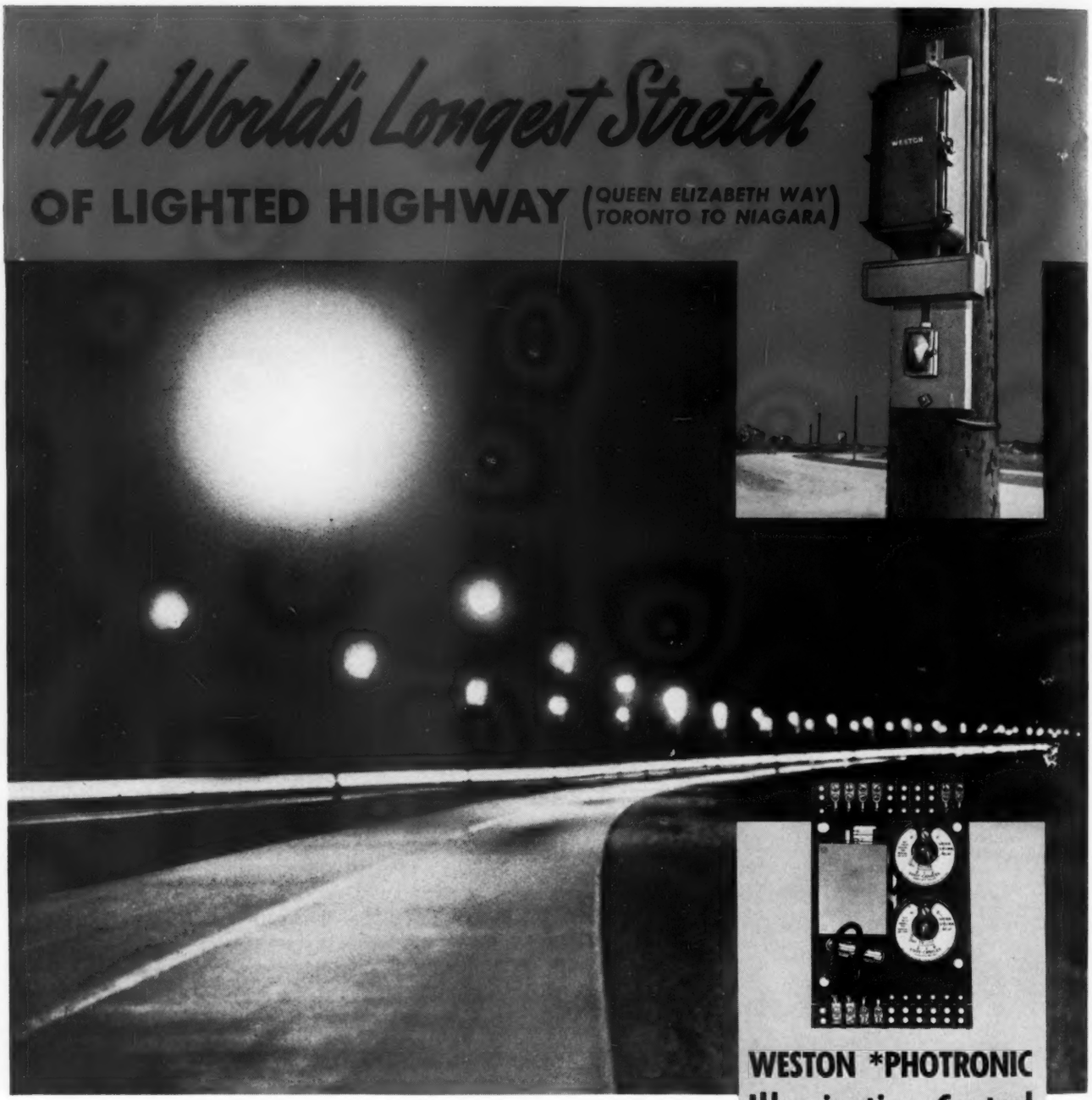
AUGUST 23, 1941



"QUEEN ELIZABETH WAY"—LONGEST LIGHTED HIGHWAY

the World's Longest Stretch

OF LIGHTED HIGHWAY (QUEEN ELIZABETH WAY TORONTO TO NIAGARA)



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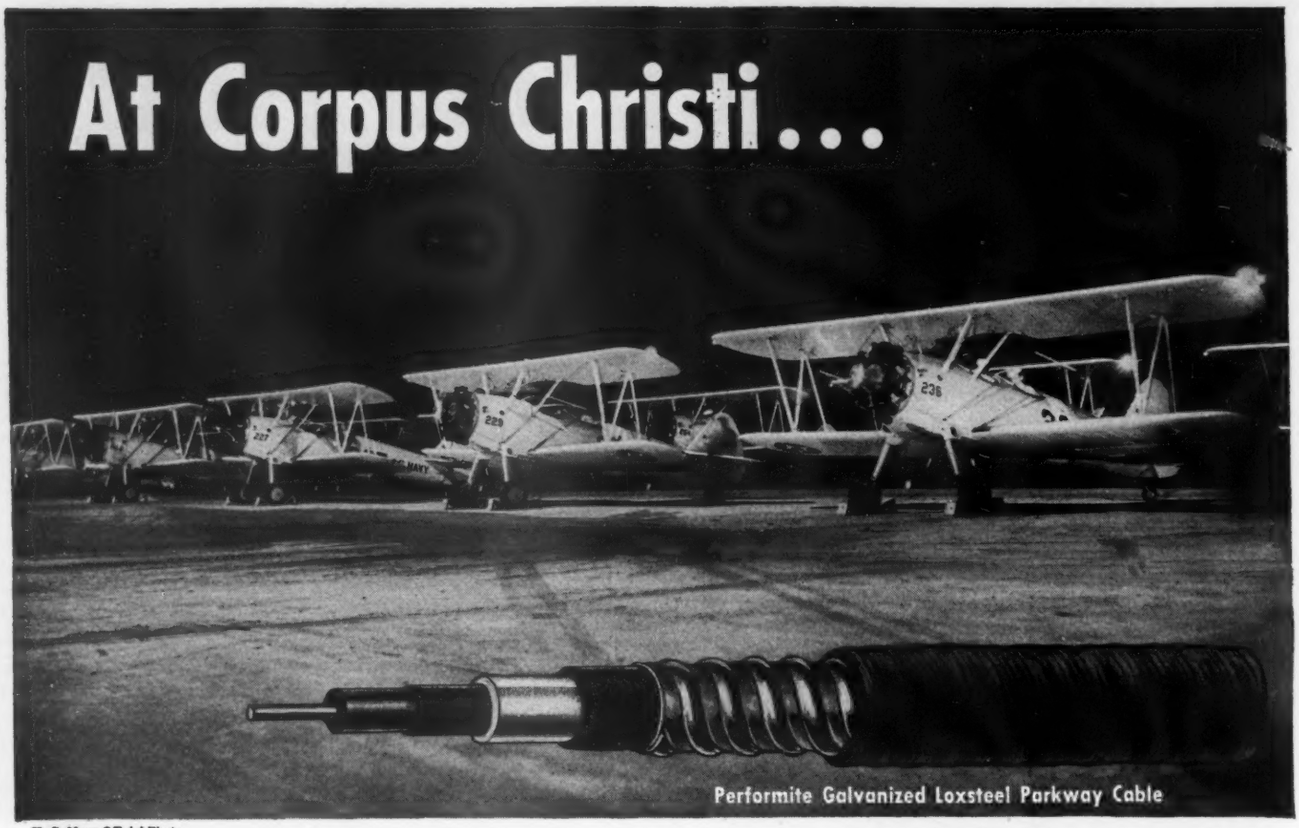
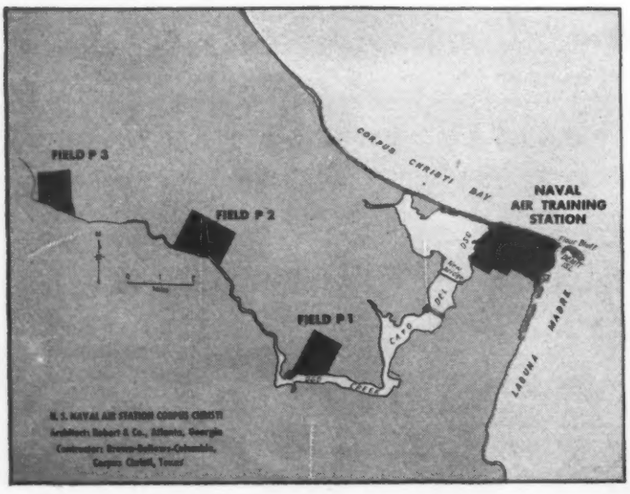


U. S. Navy Official Photo

P-2 Trainers (Night Flight) Ready to Take Off

283,000 Feet of Hazard Armored Cable Light the Way for Eagles and Fledglings

In the electrical distribution system at the new Naval Air Station in Corpus Christi, Texas, over a quarter of a million feet of Hazard Loxsteel Armored cables carry the power for boundary lighting, flood-lights, buildings, hangars and shops.



Built to rigid U. S. Navy specifications JC-121 and JC-106A, these cables also comply with the necessary requirements of the Civil Aeronautics Authority for airport lighting cables.

This outstanding installation at the Corpus Christi airfield follows a long succession of prominent airport lighting jobs from coast-to-coast in which Hazard has been privileged to supply the cables.

Full information on the many Hazard electrical cables for airport, airway and other power and light purposes is yours for the asking. Without obligation, Hazard engineers will gladly assist you in recommending proper cable designs for any electrical application.

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History's Promise

Several histories, one of the central station industry as a whole and others relating to individual utility companies, are being compiled. Not only should they make excellent reference material but they should be an inspiration both to people now employed in the industry and to the young men who are looking for employment opportunities that have an assured future.

The history of this industry, while short in point of years, is long in its record of accomplishment. In the short space of less than sixty years it has come from nothing to be the purveyor of the most important mechanical force in civilization.

In these years centrally supplied electricity has transformed living. Life is more comfortable, goods are better, more plentiful and less costly, the luxuries of comfortable living no longer are accessible only to the rich, entertainment is more varied, education more widespread, working hours lessened, pay envelopes are larger.

Utilities cannot claim all of the credit for these advances in national and social economy, but the record will show that without central station power and the development and expansion thereof by central station men the degree of advancement in living and in production standards would be far, far less.

One thing these histories should clearly prove is that, irrespective of corporate, financial, regulatory or even of management or ownership changes that may come, the prospects for the use of electric service are brighter today than they ever were. The history of this industry will show that while at times the spectacle of large amounts of surplus capacity was appalling it has nevertheless always served as a stimulus to wider use.

In fact, the record of the past, if good for anything at all, is as a guide to the future. And during these troublesome days of war on the one hand and economic theories of those in high government position on the other, the one bright spot is the knowledge that what has been done can be done again. The use of electricity after peace is declared must be extended in peaceful application to a degree few of us have ever contemplated.

Sometimes people cannot believe that such things are possible, probably because they are too close to the problems of today. History does not record the doings of people of such limited perspective. Only those whose minds have grasped the opportunities of the unexplored future find a place in the record of man's achievements. And so it will be again.

This is the promise that history makes.

ROUTE of Queen Elizabeth Way

World's Longest

R. E. JONES,* Hydro-Electric Power Commission of Ontario

THE WORLD's longest continuously lighted artery is the Queen Elizabeth Way in Ontario, extending from Toronto to Niagara Falls, a distance of 70 miles, with a further extension of 20 miles proposed to Fort Erie, opposite Buffalo, N. Y. This is a heavily traveled road through a thickly populated industrial area. The military value of such a road, according to the Department of Highways, was a factor in its construction during the war. It is well lighted throughout for safe night driving, making use of the silhouette principle instead of direct illumination.

There are two concrete lanes, each 20–23 ft. wide, with center boulevard of 28–30 ft.

Position of the poles in the center of the boulevard was decided upon after experiments had been made with various arrangements. This results in a minimum number of poles, and the poles are structurally balanced.

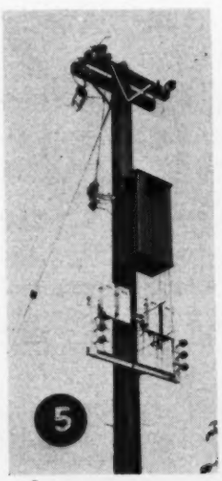
Power circuits were available along the entire route, which was one factor in the decision to install a multiple instead of a series system. When, as occasionally happens, a pole is knocked down, the balance of the circuit remains in service and the exposed conductor is of no higher voltage than 115.

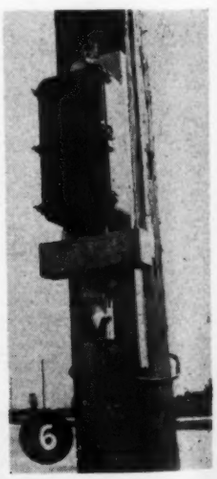
On account of cheap power and the higher cost of equipment in Canada, incandescent lighting was selected. Some sodium units were purchased and are now used in place of standard incandescent units to mark intersections where the usual type of signal is not desired.

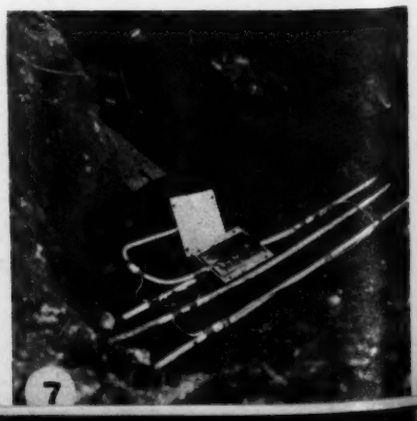
Lamps are 6,000-lumen, 405-watt, multiple type, with a life of 3,000 hours. They are replaced semi-annually on a group replacement schedule.

Power is purchased at 2,300 volts.

The installation is owned and operated by the Department of Highways of Ontario. Engineering and construction was carried out by the Hydro-Electric Power Commission of Ontario.







* Assistant Engineer.

Stretch of Lighted Highway

Dual roadway with wide dividing parkway — Mostly center poles with long mast-arms — Buried cable system is multiple with full photronic control of lighting

---

1. Typical section of Queen Elizabeth Way before planting of center strip. Eventually the poles will be hidden by the growth of trees. Welded steel mast-arms are used to support the luminaire 26 ft. above the pavement and overhanging same 3 ft. Poles are Class 5, Western red cedar, shaved and stained green, with ½-in. penetration creosote treatment of butts.

2. On curves standard spacing is reduced from 200 to 150 ft. Incandescent luminaires have 6,000-lumen multiple lamps.

3. Mast-arms are shortened in sections where local conditions necessitates narrowed dividing strip to maintain standard 3-ft. overhang of pavement.

4. Cable riser at each pole consists of a single conductor, No. 8 R. & L. cable beneath wooden moulding from below ground to mast-arms. As the lead sheath is used as the grounded side of the circuit, the pothead is attached to the cable by belling out and clamping the lead beneath a bushing. There is a ground screw on the side of the pothead, and asphalt is used to seal the cable inside the body.

5. A standard distribution transformer is located at the side of the road each half mile. This is supplied at 2,300 volts from an existing rural circuit. Below the transformer is a steel rack supporting four relays and a three-wire bus. Transformers are painted green to identify them as road-lighting equipment.

6. A photronic control is installed each 6 miles to turn the lights on and off. The controller, fuse and connection box and lock switch to permit turning on in daytime for servicing are mounted on a steel channel. In the daytime the controller energizes the control cable which holds open all the relays in the section. Thus, failure in the control circuit will turn lights on in daytime, instead of turning them off at night.

7. Taps to the main cable are made by removing the lead sheath and making a soldered and rubber and friction-taped joint. The joint is then placed in a slotted iron or wood box and filled with "crack-filler" asphalt. As the lead sheaths act as a neutral conductor, they are all bonded together at each tap point. For a bond, No. 6 copper wire is used, attached to the lead with a binding of No. 16 tinned copper wire and soldered.

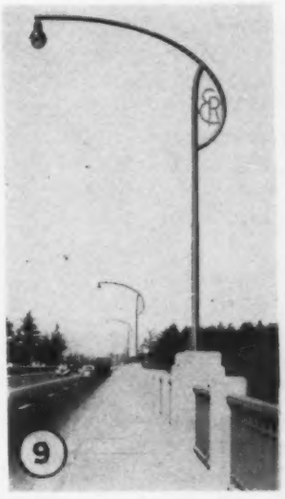
8. Trench is dug near pavement by machine and backfilling is done with a scraper.

9. For the concrete bridges a suitable standard was designed by the Department of Highways. It has a projection of 10 ft. and is of welded steel pipe. The monogram represents Elizabeth Regina.

10. At the Toronto entrance steel standards were used on one side of each traffic lane.

11. Cables are placed in the trench by hand, one at a time. For identification, one line cable is painted red opposite each pole as it is installed. As this part of the boulevard will never be disturbed by placing of signposts or trees, cable cover blocks are used on lateral runs only.

12. Lighting cables for multiple circuit are 600-volt rubber and lead (No. 3) with No. 6 cable for control. Between sections a bare No. 8 wire is used to add to the conductivity of the one lead sheath at that point.



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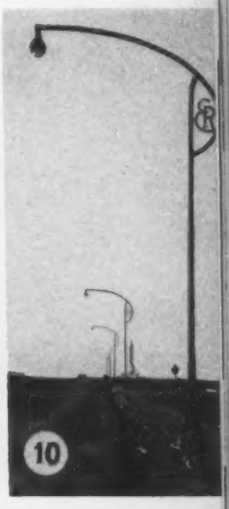

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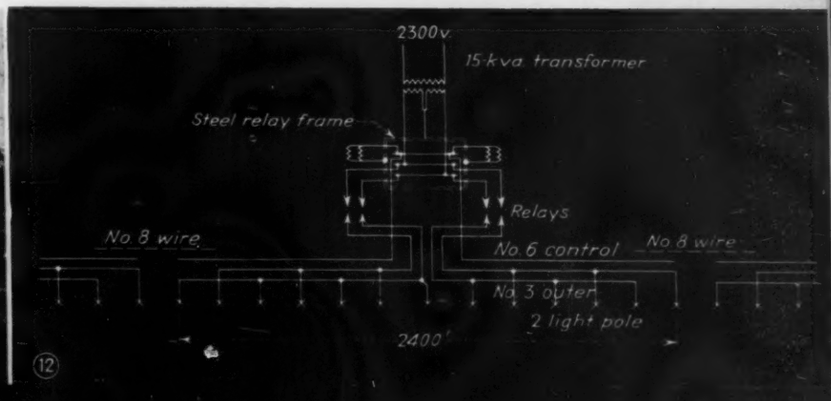

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Metering 4-Wire, 3-Phase Delta Services—I

Analysis of eight methods used by utility companies — Choice depends on individual conditions — Unbalanced phase loading, due to lighting, an important factor

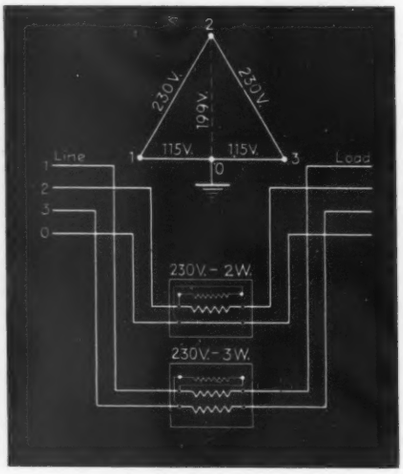
RALPH A. POWERS, Boston Edison Company*

BECAUSE four-wire, three-phase, delta distribution has been less widely used than four-wire, three-phase Y, methods of metering the former type of services have been given comparatively little attention. Recent interest in this method of supplying service warrants serious thought as to the proper type of metering to use. A survey of utility practice covering scattered sections of the country brought out much valuable information, and much of the data presented in this paper were obtained from these sources.

A four-wire, three-phase, delta service is usually supplied from a bank of three single-phase transformers with secondaries in delta. One of these transformers, usually larger than the two others, has a tap brought out at its mid-point. This tap is grounded and is known as the neutral. A bank of single-phase transformers so connected can supply 115/230 volts, three-wire, single-phase for lighting as well as 230 volts, three-wire, three-phase for power. From two phases to ground 115 volts exists, while from the third phase to ground we get approximately 200 volts (230 × cos. 30 deg.). It is possible to use two transformers only, connecting them in open delta, in which case the same voltages are available as with the closed delta.

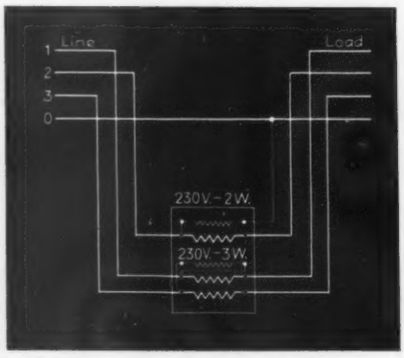
Four-wire, three-phase delta distribution presents interesting metering problems capable of varied solutions.

At least eight methods are in use, the choice depending largely on individual company conditions. Service may be supplied in two general ways by (1) combined light and power over a four-wire service; (2) separate light and power supplied over individual three-wire services. The latter is usually found where existing services are changed over to the four-wire delta system.



METHOD I—Use of two single-phase meters (one two-wire and one three-wire), self-contained, rating 50 amps. or less.

Both elements may usually be of the same amp. rating, though not essentially. Element rating may be chosen to conform to the maximum load in the phase or phases connected. Only 5, 15 and 50-amp. elements in modern meters should be used. Total registration is the sum of the registrations of the two meters.



METHOD II—Two-element delta meter connection, self-contained. One two-wire and one three-wire element have the same current rating

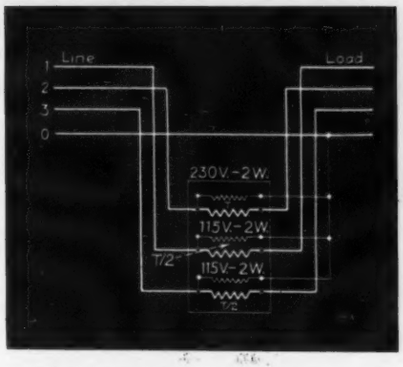
The following methods are considered from viewpoint (1), viz., where metering is required for a combined light and power load with four-wire service. First to be considered are the smaller loads where a meter of not over 50 amp. rating would be suitable.

Method No. I should be used only where it is unnecessary to measure demand and where the use of two meters for a single class of service to an individual customer is permissible. It may be slightly more economical than any other method which might be used at present, and the installation may be made with detachable type, single-phase watt-hour meters.

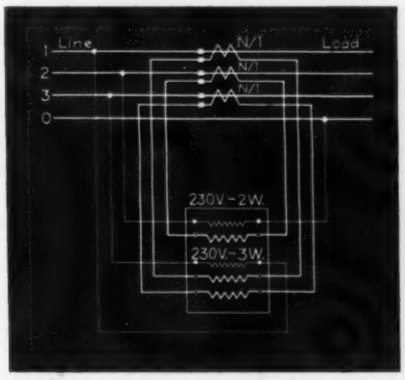
Method No. II is preferred for this class of capacity service and utilizes the watt-hour meter known as the four-wire, three-phase, two-element delta meter. It combines the two single-phase meters of Method I into a single meter which will correctly measure both single-phase lighting and three-phase power loads, except for a possible error due to unbalanced voltages and currents in the three-wire element. This error is of little importance for meters in self-contained ratings and exists wherever a standard single-element, three-wire meter is used.

By using the two-element delta meter demands can readily be ob-

* From a paper before the New England Association of Meter Engineers. Second part will appear in a subsequent issue.



METHOD III—Three-element delta meter, self-contained Two 115-volt, two-wire and one 230-volt, two-wire elements are used



METHOD IV—Two-element delta meter, transformer rated. One two-wire and one three-wire element having the same current rating

tained and total registration is given on a single register. The meter is standard and costs about $33.50 (50-amp. size), as compared with $30 (same size) for a standard three-wire, three-phase, two element meter. By using meters of modern types relative magnitudes of the lighting and power loads on the combined services are of no great consequence because of the extended overload characteristics of the individual elements, which can be based on the maximum average load of the service conductor which carries the greatest load.

Testing of these meters is no more difficult than the ordinary three-wire, three-phase, two-element types. Single element tests, if made, should be at service voltage. In making a series check, either or both the normal operating voltages may be used. The large majority of the companies surveyed favored the two-element, four-wire, three-delta meter and used it extensively.

Method III utilizes a three-element, four-wire, three-phase delta, self-contained meter having a 230-volt, two-wire element and two 115-volt, two-wire elements. This satisfies Blondel's requirements, as it has one less element than the number of wires in the circuit and so will measure the load correctly under all conditions. The current coils of the 115-volt elements must have one-half the number of turns as in the 230-volt element. As a result, the thermal capacity of these elements has been increased, giving them double the current rating of the 230-volt element, an important advantage when the load in the lighting phases greatly exceeds that in the power phase. These meters are rated on the basis of the 230-volt element's current rating and the nameplate shows the current and voltage rating of all three elements. Because of the two voltage ratings, however, this meter has considerable disadvantage from the testing standpoint, requiring special connections and procedure.

One method of test is to connect the two 115-volt coils in series across 230 volts and in multiple with the 230-volt potential coil. Another is to connect the 115-volt coils as they are in service between two-phase wires and neutral and to connect the 230-volt coil and portable test standard across this same phase.

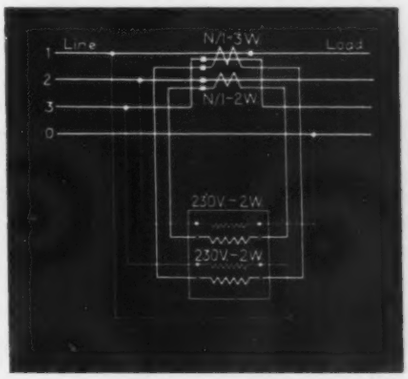
Current Transformers

Where current transformers are required a number of factors enter. Since the older type instrument transformers cannot be materially overloaded for any considerable time, the relative magnitudes of the loads in the lighting and power phases are important.

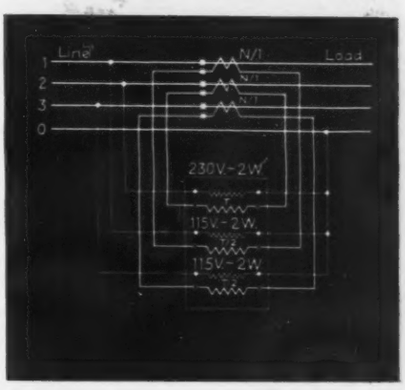
Method IV utilizes a three-phase, four-wire, two-element delta meter and is similar to Method II except that current transformers and transformer-rated meters are used. All three current transformers have the same ratio.

Method V employs a two-element, three-wire, three-phase meter used with one two-wire and one three-wire current transformer. This is an alternate method, and while slightly more economical than the scheme of Method IV has limitations. Standard three-wire current transformers are not available in capacities above 500 amp. and are usually of inferior insulation and accuracy characteristics compared with the two-wire transformers which would normally be used. Many companies have discontinued the use of three-wire transformers, and additional transformer stocks would be required where Method V is used. The standard two-element meter has advantages over a more or less special meter, and where three-wire transformers are available in proper capacity the use of this method may be preferred. Method IV, however, may lend itself more readily to standardization of installations.

With a relatively large lighting load further consideration (Method VI) may be given to any possible error due to unbalanced voltages and currents in the three-wire, single-phase circuit. For this a transformer-



METHOD V—Use of two-element standard, 230-volt, three-phase, three-wire meter, with two two-wire elements having the same current rating; transformer rated



METHOD VI—Three-element delta meter with current transformers. Two 115-volt, two-wire and one 230-volt, two-wire elements

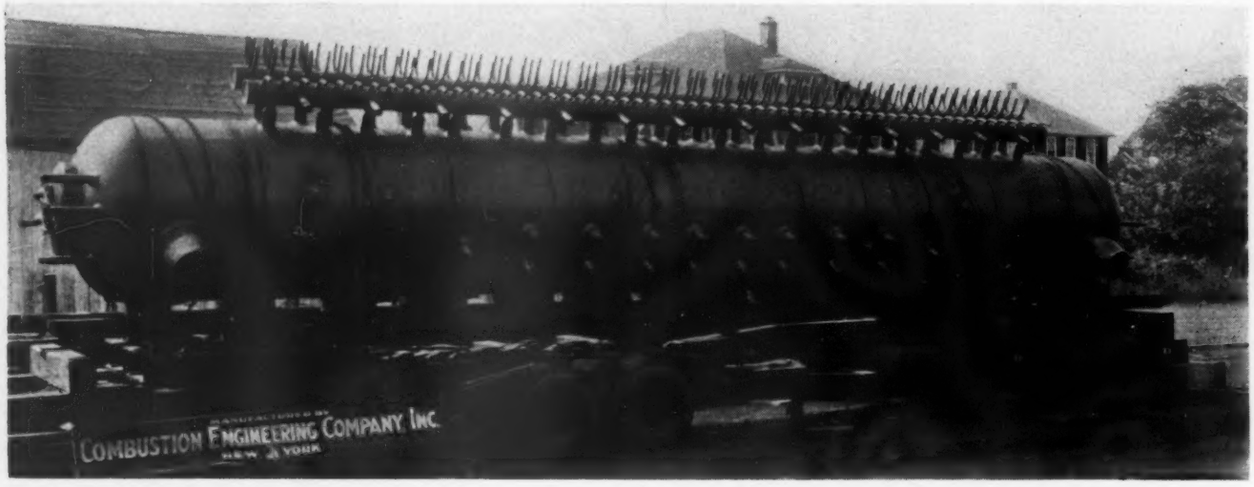
rated, three-element, four-wire, three-phase delta meter of standard manufacture is available. Each phase has a current coil and the potential coils are supplied from each phase to the common neutral. This meter thus has one 230-volt, two-wire element and two 115-volt, two-wire ele-

[*Continued on page 118*]

First American Utility Plant Uses Forced Feed Circulation

Montaup steam generator embodies the Lamont principle of design — Topping unit included in development to run at 1,800 lb. and 950 deg. F.

FRANK S. CLARK,* Stone & Webster Engineering Corporation



MAIN DRUM of Montaup boiler

THE FIRST forced recirculation steam-generating unit to be installed commercially in this country, and which is to deliver steam at the superheater outlet at 1,825 psi. and 960 F. to supply a 25,000-kw. topping turbine, is now being erected at the Somerset (Mass.) plant of the Montaup Electric Company, near Fall River. Decision to adopt these steam conditions was made because in this case a topping unit of reasonable capacity could be used which, in combination with the existing topped lower pressure turbines, would be well adapted to the ssystem load. High-pressure condensing capacity was considered as an alternate, but did not show itself as economical as superposition.

Although the steam conditions required the use of the combined reheat-regenerative cycles, this was not considered a handicap. The amount of reheat is small, less than 150 F., and the operation is not complicated thereby. Two installations using higher steam pressures are already in operation at Twin Branch and Diamond Alkali.

The most unusual feature of this installation at Somerset is the forced circulation boiler. The manufacturer has had the American rights for this type of steam-generating equipment for several years, and with a European background of some 700 units in operation has been busy adapting it to standards of reliability and efficiency demanded in this country. He has discussed its features for the past two years with members of committees of at least two of the associations of the utility industry. Consequently, these were fairly well known when the question of a boiler for Somerset was taken up.

Conditions were peculiar in that the installation was to be made in a space in an existing building intended for a boiler of 200,000-lb.-per-hour output and of radically different design. To have remodeled the building would have been too expensive. Consequently, a boiler of low natural hydraulic head was demanded, and for the output desired it was extremely doubtful in the minds of the engineers if a natural circulation boiler would operate satisfactorily. The Lamont forced circulation design then came into the picture.

In so far as arrangement of heat-absorbing surfaces, heat generation and absorption and other general features are concerned, the same conditions apply as in other steam-generating equipment. Smaller diameter furnace tubes and control of circulation cut down very appreciably the ratio of water circulated to steam gen-

*Consulting engineer.

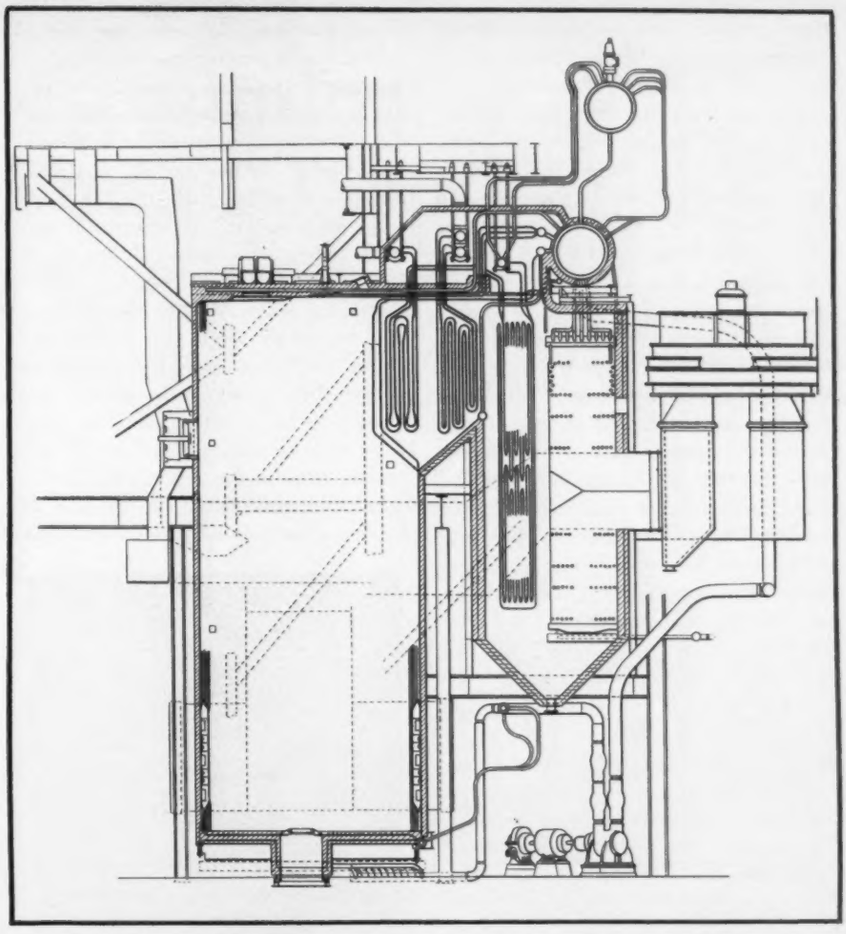
erated. This is of the order of 3.85 to 1. This lessened ratio and a steam density of about 5 lb. per cu.ft., together with the use of a dry drum, should prevent major problems due to carryover.

The major concern was about the circulating pumps, particularly packing against high pressure and high temperature water (2,000 psi. and 635 F.). The method adopted of using boiler feed discharge water at some 300 deg. F. lower temperature and the design of labyrinths is expected to solve this problem. The combination of turbine and motor drive and methods of control worked out should safeguard the reliability of operation and provide against damage due to unforeseen emergencies.

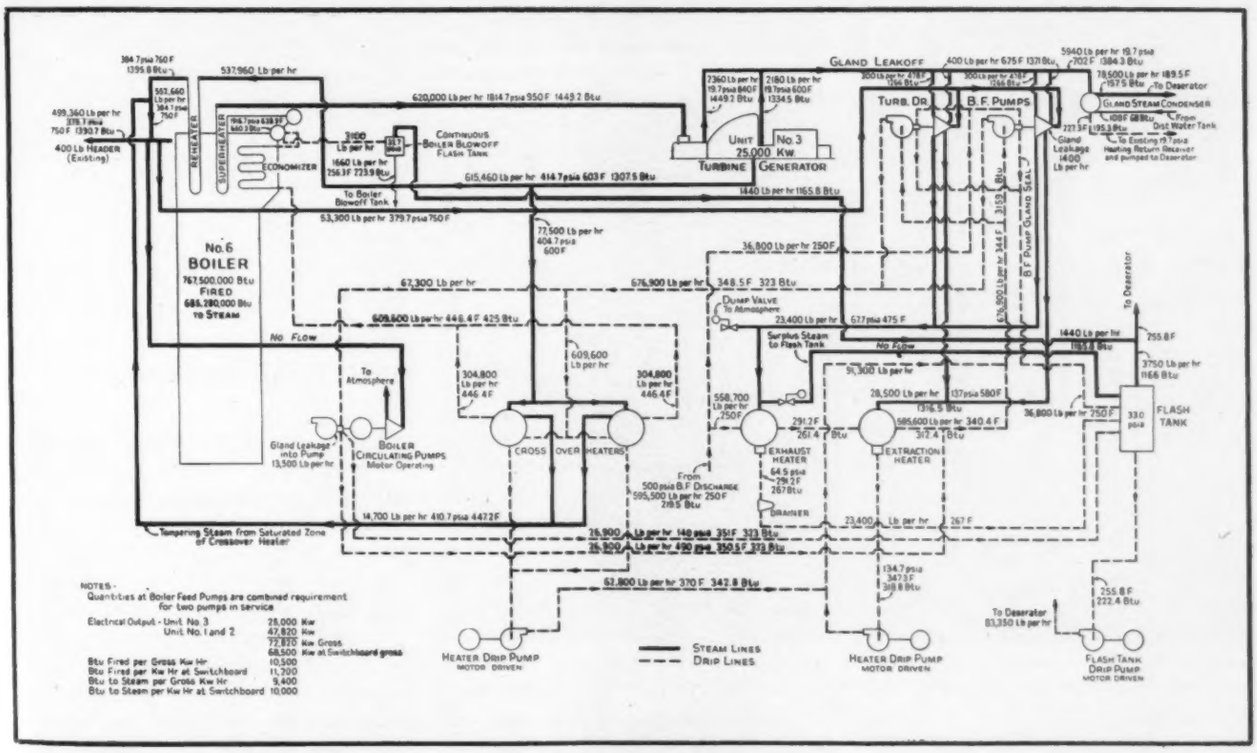
The new boiler occupies space originally laid out fifteen years ago for one of less than one-third its steaming capacity.

Major Features of Boiler

The steam generator, a Combustion Engineering boiler with a continuous capacity of 650,000 lb. per hour, resembles closely in general arrangement a boiler having natural circulation. The furnace (slag bottom type) is completely water-cooled,


SUPERHEATER
ECONOMIZER
CONTINUOUS BOILER BLOWOFF FLASH TANK
UNIT No. 3 25,000 KW TURBINE GENERATOR
TURB. DR.
B.F. PUMPS
GLAND STEAM CONDENSER
To Deaerator
Dist. Water Tank
No. 6 BOILER
767,500,000 Btu FIRED
685,280,000 Btu TO STEAM
400 Lb HEADER (Existing)
To Boiler Blowoff Tank
Dump Valve To Atmosphere
Surplus Steam to Flash Tank
No Flow
To Atmosphere
Gland Leakage into Pump 13,500 Lb per hr
BOILER CIRCULATING PUMPS Motor Operating
CROSS OVER HEATERS
EXHAUST HEATER
EXTRACTION HEATER
DRAINER
FLASH TANK
Tempering Steam from Saturated Zone of Crossover Heater
HEATER DRIP PUMP MOTOR DRIVEN
HEATER DRIP PUMP MOTOR DRIVEN
FLASH TANK DRIP PUMP MOTOR DRIVEN
STEAM LINES
DRIP LINES
NOTES -
Quantities at Boiler Feed Pumps are combined requirement for two pumps in service
Electrical Output - Unit No. 3 25,000 Kw
Unit No. 1 and 2 47,820 Kw
72,820 Kw Gross
68,500 Kw at Switchboard gross
Btu Fired per Gross Kw Hr 10,500
Btu Fired per Kw Hr at Switchboard 11,200
Btu to Steam per Gross Kw Hr 9,400
Btu to Steam per Kw Hr at Switchboard 10,000

CROSS-SECTION of 650,000-lb.-per-hour boiler designed for forced circulation



HEAT BALANCE DIAGRAM for high-pressure installation at Somerset station

the walls, floor and roof being formed by vertical tubes 1¼ in. outside and 1 in. inside diameter. Practically the entire amount of steam will be generated in the furnace tubes, the only convection tubes being in a single row, widely spaced, at the back of the superheater. All tubes terminate in two crossheaders which discharge into the main drum. This is of welded construction, 54 in. internal diameter and about 38 ft. long. Steam will pass from it into a dry drum 48 in. internal diameter and about 22 ft. long.

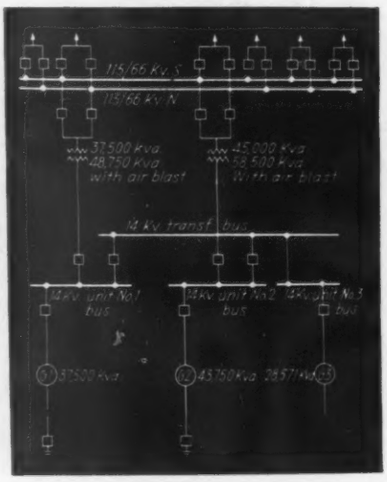
A two-section Elesco superheater is provided. Steam from the turbine will pass through an Elesco reheater located between the two superheater sections, the pressure being 400 psi. with entering and leaving temperatures 603 and 760 F. There will be an Elesco economizer behind the lower-temperature section of the superheater. Water will enter at 446 F. and leave at 520 F., being discharged into the bottom of the main drum. Control of superheat temperature will be by two sets of horizontal dampers in the gas exit from the unit. By varying the relative position of these sets the flow of gas over the lower temperature superheater may be regulated to give the maximum desired steam temperature with outputs of from 480,000 to 650,000 lb. steam per hour.

Forced Circulation Pumps

Forced circulation will be effected by three Ingersoll-Rand centrifugal pumps located immediately behind the furnace. Each pump will have a capacity of about 1,400,000 lb. water per hour. Two of the pumps will be both motor and turbine driven and one motor-driven only. Two pumps will provide full circulation for the boiler at maximum output. Water is drawn from the drum at each end, 14-in. down-comers delivering to a header at the rear of the boiler from which the pumps take their suctions. The pump discharges will be connected with the water wall headers at the bottom of the furnace through 3½-in. tubing. The wall tubes will be supplied with water in pairs, each pair being fed through a 3½-in. bifurcated connection with the bottom headers. Similar construction is used at the junctions of the tubes with the upper headers.

Each boiler circulating pump is of the single impeller type, the wheel being overhung to avoid the use of an outboard bearing and stuffing box. Maximum suction pressure in the pump casing will be about 1,935 psi., the water temperature being 630 F. The head necessary to maintain proper circulation through the tubes and headers will be about 50 psi. Each pump will run at 1,760 r.p.m. and require about 175 hp. to drive.

Sealing water for the stuffing box will be taken from the boiler feed pump discharge and admitted at an intermediate point in the gland. This water will be at 340 F. and the pressure will be maintained at 25 psi. greater than in the pump casing. The amount required will be about 75 g.p.m., of which 15 g.p.m. will leak



ONE-LINE DIAGRAM of generator and transformer connections. G1 and G2 are the older units. G3 the new topping unit

into the pump through a labyrinth and enter directly into the boiler circulation. The remainder will pass through a second labyrinth, in which the pressure will be reduced to 475 psi.; 30 g.p.m. will be taken at this point and returned to the header immediately preceding the boiler feed pump suction. The remaining 30 g.p.m. will have its pressure reduced to 115 psi. in a third labyrinth and will be discharged into a low-pressure flash tank. Ordinary ring packing will be used in the remainder of the stuffing box. Between the pump and its drives will be a Kingsbury thrust bearing. A motor-driven auxiliary pump will be used when starting up, to circulate oil through the bearings, but when operating, a pump geared to the shaft will be used for this purpose.

At least one dual-driven unit will be in operation at all times when steam is being generated. The pump turbines will take steam at about 380 psi. and exhaust to atmosphere, as they are intended for emergency use only.

Tangential firing will be provided through four sets of burners at the corners and near the bottom of the furnace. Each set will contain three coal and two oil burners. In order to aid in maintaining maximum steam temperature at reduced output and when using fuel oil in the main burners, a row of four oil burners will be installed in the front wall near the top of the furnace. The lower limit of temperature control with either coal or oil will be 480,000 lb. steam per hour.

Pulverized coal prepared in a separate building will be fed to the burners from an enlarged bunker of 520 tons capacity by twelve feeders arranged in three groups, each serving four burners. The fuel oil burners will be connected with existing fuel oil supply lines.

Three eight-stage Ingersoll-Rand high-pressure boiler feed pumps will be provided, each having a normal capacity of 425,000 lb. per hour at 3,520 r.p.m. and against a total dynamic head of 4,400 ft. Under this condition about 1,390 hp. will be required. Normally two pumps will be in operation, but should one fail the characteristic curve is such that by increasing the speed to 3,870 r.p.m. the remaining pump will deliver 625,000 lb. per hour, or practically full capacity requirements. Under this condition 2,040 hp. will be required. Each pump will be driven by a ten-stage non-condensing G.E. turbine taking steam at 360 psi. and 750 F. and exhausing at 57 psi. into a closed feedwater heater. The turbines will have openings for extraction of steam at about 122 psi. for feedwater heating.

Other Equipmemnt

Other major equipment includes the economizer (24,500 sq.ft. heating surface); two Ljungstrom air heaters raising the air temperature for combustion to 531 F. and reducing the flue gases to 290 F.; two Sturtevant 179,500-c.f.m. induced-draft fans, 800 hp. hydraulic-coupling drive; two Sturtevant 110,000-c.f.m., 400-hp. forced-draft fans; two 69-hp. Sturtevant primary air fans, and Copes feedwater control. Synchronous mo-

[*Continued on page* 66]

Revamped Substation Continues Radial Distribution

Conversion of 2.3-kv. substation to 4 kv. provides capacity for overload relief for adjacent 4-kv. substations and circuits

B. M. JONES and D. M. NEWELL,† Duquesne Light Co., Pittsburgh, Pa.*

APPROXIMATELY twenty years ago the Duquesne Light Company adopted a policy of using a four-wire, three-phase, four-kv. distribution system in place of a 2.3-kv. delta system. Since that time all major additions have been to the 4-kv. system, and additional substation and distribution capacity has been provided either by establishing new 4-kv. substations or by converting 2.3-kv. substations to 4-kv. when overload relief was necessary.

Having established a 4-kv. system, it has proven economical to retain certain 2.3-kv. substations by reducing the service area to prevent overloads, and in effect providing new 4-kv. capacity to take care of the load growth. Thus, the conversion of 48th Street substation to 4-kv. has been postponed by transferring the load (Fig. 1) in parts of the area to Lawrence and East End substations (existing 4-kv. substations). Two large customers (of the order of 600 to 1,000 kva.) in this area have also been transferred from the 2.3-kv. distribution system to the 22-kv. transmission system.

Capacity Absorbed

Development of the distribution system in this area has now reached the point where the load of all three substations is approaching capacity. Recent studies indicate that additional capacity will be required in 1941, and a number of schemes have been investigated to find an economical method of providing the necessary capacity. Also, 48th Street substation serves an industrial district, and it is felt necessary to increase its capacity and improve its reliability to take care of the large increases in industrial loads of a national defense nature.

It did not appear practical to expand the existing 4-kv. sources (Lawrence and East End), and a decision was made to provide a new 4-kv. supply. Various schemes were studied, and this article will outline two of the methods considered.

One method considered was to convert 48th Street substation to 4 kv. and serve the area from three 4-kv. circuits. This will be referred to as the "Radial Scheme." Another method was to install 2,000-kva. unit type 22/4-kv. substations at different locations in the area. This will be called the "Unit Scheme" for purposes of this article.

Radial Scheme

The present substation is quite old and consists of two 2,000-kva., 22,000/2,300-volt transformer banks, one 930-kva., 22,000/2,300-volt transformer bank and one 12,500-kva., 22,000/11,000-volt bank for a 7,500-kva. synchronous condenser.

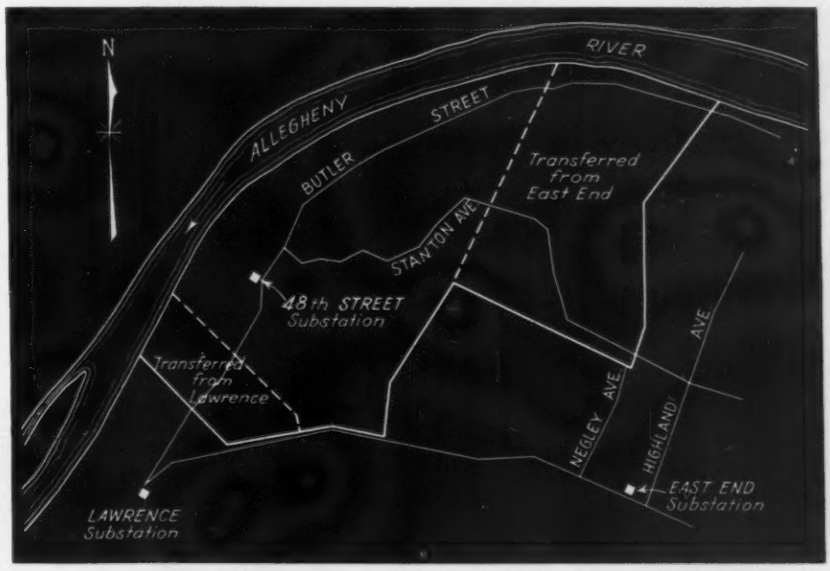


FIG. 1—Some main through streets of the area. Load of 48th Street and Lawrence substations, particularly along the river, largely industrial. East End substation serves important business district of East Liberty and surrounding residential area, including some light industrial load. Solid line is boundary of proposed 48th Street substation area. Areas to be transferred from adjacent substations are indicated

* Division engineer, † sub-section engineer, systems planning and development department.

There are five 2,300-volt distribution circuits, two regulated and three unregulated, and several 22-kv. incoming lines and several 11-kv. outgoing lines.

Actually, this substation has "just grown" and different pieces of equipment have been added from time to time in an inexpensive manner, until we have reached a point where it is not at all satisfactory to increase the installation without a major rebuilding program. Also, due to the age of the 11-kv. and 2.3-kv. switchboards requiring excessive maintenance, and due to the congestion of the 11-kv. and 2.3-kv. equipment in light of modern safety requirements, it is becoming rather hazardous to personnel and service to maintain the old equipment in this substation. Working space for repairs and maintenance, particularly around incoming cable terminals and disconnecting switches, is very limited and totally unsatisfactory.

Simplified Layout

The new installation is planned for two 6,000-kva. units and three three-phase, four-wire, 4-kv. regulated distribution feeders (Fig. 2). The 7,500-kva. synchronous condenser supply through the present 2/1 transformer bank to the 22-kv. bus will be retained for voltage regulation of the transmission system in this district. All 11-kv. outgoing circuits and their switchboards will be entirely eliminated from this substation and their loads will be picked up on the 22-kv. transmission system in this district. However, some of the released 11-kv. bus structure and its associated equipment will probably be used for the new 4-kv. installation, a real saving in itself. The initial installation will be laid out to accommodate an ultimate of five 300-amp., three-phase, four-wire, 4-kv. regulated circuits.

At the present time separate 2.3-kv. lighting and power circuits are in use in the 48th Street substation area. However, it is planned to form combined lighting and power circuits when the area is converted to 4 kv. Thus, three 300-amp., 4-kv. circuits can replace the present five 2.3-kv. circuits.

Each proposed 4-kv. circuit is of the feeder-main type and 4-kv. ties are provided to adjacent circuits to facilitate operation, particularly under emergency conditions. Sectionalizing switches are also provided in the main of each circuit so that in the event of a feeder failure the circuit can be transferred to two or more adjacent circuits.

Unit Scheme

The recent publicity given to the idea of providing a distribution system from small unit-type substations made it desirable to investigate this method. In order to serve the same area as in the Radial Scheme it would be necessary to install at least three 2,000-kva. units. Each unit installation would consist of a self-contained 22/4-kv. unit-type transformer, in-

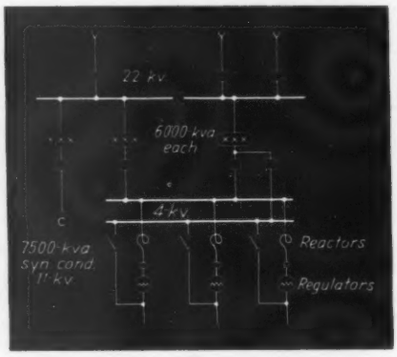


FIG. 2—Simplified single line diagram for 48th Street substation as proposed in the 1941 budget

Space for a total of five 300-amp., three-phase, four-wire, four-kv. regulated circuits is provided. Synchronous condenser (7,500 kva.) is retained at this location for voltage improvement on both high-voltage and low-voltage circuits.

cluding step-type voltage regulator, circuit breaker on the 4-kv. side, and two 22-kv. airbreak switches on the 22-kv. side.

The 4-kv. system considered for the Unit Scheme was essentially the same as under the Radial Scheme. Each unit served approximately the same area as a circuit of the Radial Scheme, and 4-kv. ties to adjacent units and circuits were provided. The main difference between the two schemes is that under the Unit Scheme a 22/4-kv. transformer would be located near the center of each circuit and the length of the 4-kv. feeders would be reduced. However, the Unit Scheme would require the extension of the 22-kv. lines to the proposed unit locations.

Other Considerations

Forty-Eighth Street substation not only functions as a distribution center but is also an important switching station for the 22-kv. sub-transmission system. Because of this it was not economical to relocate the substation nearer the geographical center of the area served. As a matter of fact, there is a large amount of concentrated industrial power load in the vicinity of the substation, and its present location is nearer the actual load center than appears from the sketch (Fig. 1).

It is also felt that the revamping of the present old substation and the elimination of the unsatisfactory conditions, utilizing existing land and building, as well as the capacity of the incoming 22-kv. transmission system for this heavy industrial load, does not entail any unwarranted expense, as these circuits will reach into other adjacent districts and relieve those adjacent substations of sufficient load to postpone a major expenditure in their individual districts.

Radial Preferable

A comparison of the two schemes mentioned indicates a cost approximately 6 per cent lower initially in favor of the Radial Scheme. Our study also showed that the Radial Scheme could be expanded at least to the extent of one new 4-kv. circuit for 48th Street substation for about one-half the cost of an additional unit type substation.

Since each transformer of the Unit Scheme would be served from a single 22-kv. line, and while the Radial Scheme provides service from a two-bank substation served from a number of 22-kv. lines, the probability of a service outage should be less for the Radial Scheme. Of course, the transformers of the Unit Scheme could be connected together forming a 4-kv. network and eliminate this disadvantage. However, this would increase the cost and did not seem to be warranted. After consideration of these factors, it was decided to adopt the Radial Scheme, and this change has been included in the 1941 capital improvement budget.

It is not the intent here to question the use of unit type substations as an economical method of providing overload relief to an existing distribution system. Rather, it is felt that the particular case studied may be exceptional, in that present land, building, transmission and switching facilities are adequate to provide for expansion.

Secondary Network Planning—II Connections, Calculator Studies

What size secondary main? Why interlace primary feeders? Why check tentative design on network calculator? Is d.c. board sufficient?

H. G. BARNETT, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

AFTER tentatively selecting sizes and locations of transformers† a size of secondary main should be selected for the network. This size will depend on the required carrying capacity, estimated regulation and existing secondary copper size. The mains should be able to carry one-half to two-thirds of the rated capacity of the predominating size of transformer. This is based on the assumption that a part of the load on each transformer will be tapped off at the location of the unit and that the remainder will be carried by the mains on each side of the transformer location. The worst reasonable condition is that where the transformer is to be located at a point along a run of main, such† as at *e* in Fig. 1.

Probably a fourth of the load may be served directly from the transformer location and the remainder of the capacity of the transformer will be divided between two sections of main. But one section may carry a larger part of the remainder than the other section because of the next adjacent transformer on that section being out of service. Thus a half to two-thirds of the transformer rating is a good estimate of the required carrying capacity of the secondary main. The regulation for normal operating conditions can be estimated by calculating the voltage drop to the distributed loads along some sections of main where inspection indicates the worst regulation may prevail.

* Central station engineer.
† In preceding article ("Electrical World," August 9, 1941), author discussed basic data and preliminary estimates.

Checking Voltage Drop

In the example a No. 3/0 conductor on racks was selected because that size was already in place in the area. The carrying capacity of that conductor is about 75 percent of the rated full load current of the 150-kva. transformer. A check calculation for secondary main section *a-h*, assuming only the distributed ultimate load served along that main, gives a voltage drop of 2.1 volts or 1.75 percent in the main.

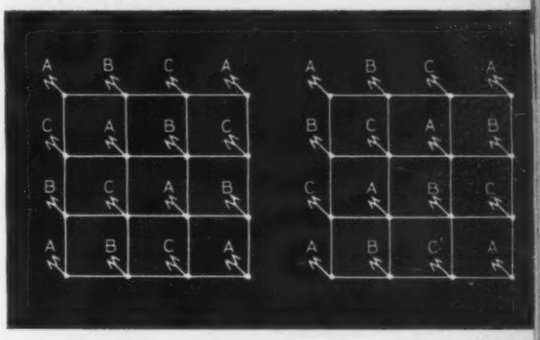


Fig. 3—Interlacing of three feeders A, B, and C in a regularly spaced network

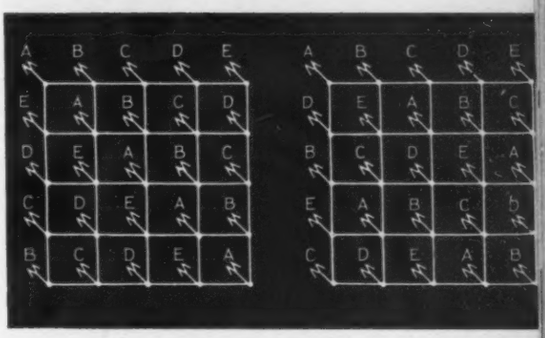
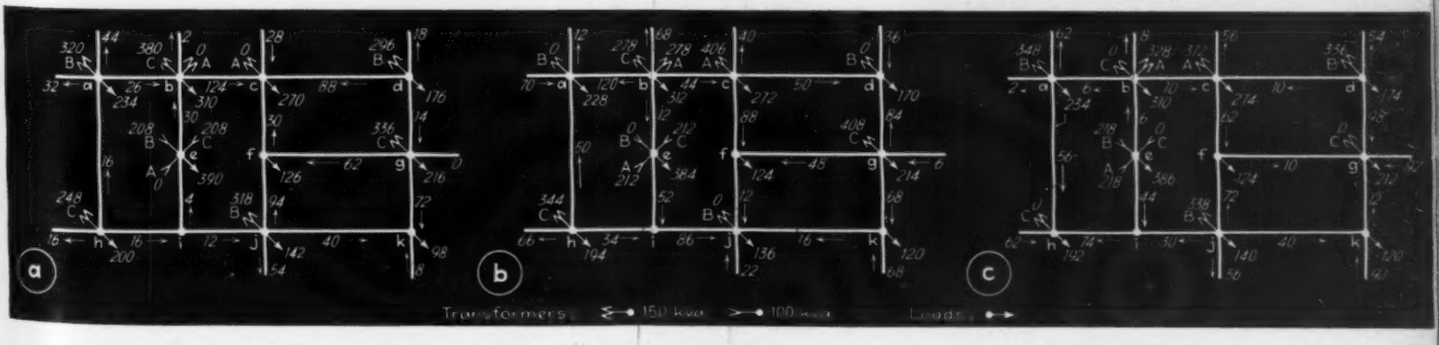


Fig. 4—Interlacing of five feeders A, B, C, D and E in a regularly spaced network

Fig. 5—Emergency load division in amperes in a section of a typical network. (a) With Feeder "A" out of service. (b) With Feeder "B" out of service. (c) With Feeder "C" out of service



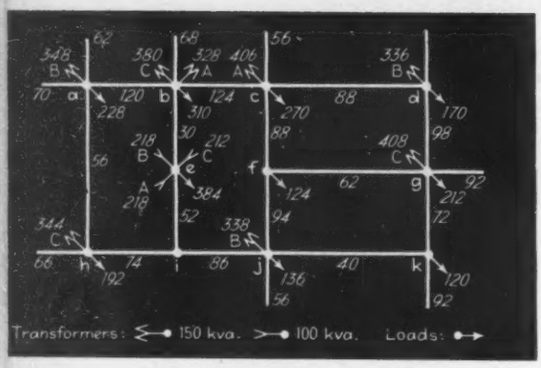


Fig. 6—Summary of worst emergency loads in amperes in a section of a typical network

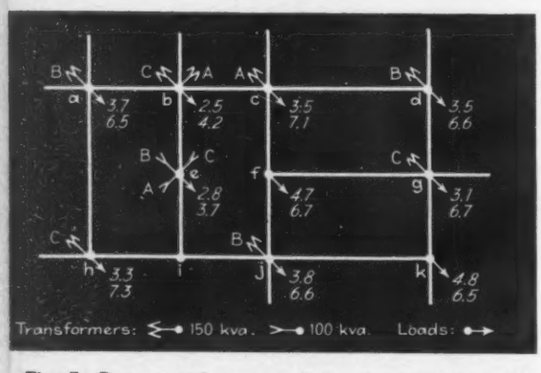


Fig. 7—Percent voltage regulation in a section of a typical network. The upper value is for normal peak load operation when all feeders are in service. The lower value is the worst peak load regulation when a feeder is out of service

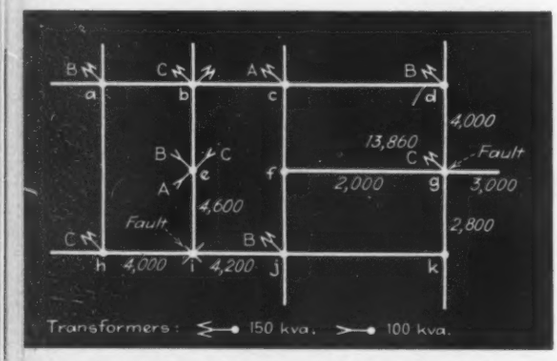


Fig. 8—Typical fault currents in amperes to solid three-phase faults in a section of network

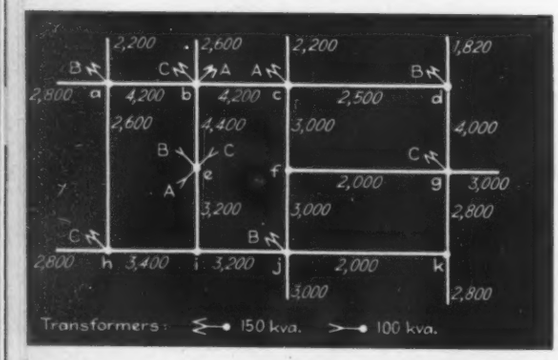


Fig. 9—Minimum fault current in amperes, in each main of a section of a typical network, available to burn off a solid fault

In underground systems, 250,000, 350,000 and 500,000-cir.mil or two paralleled No. 4/0 conductors are used, corresponding approximately to the use of 225-, 300-, and 500-kva. transformers. Two No. 4/0 or two 250,000-cir.mil conductors per phase are better than one 500,000-cir.mil conductor per phase in most respects. The smaller conductors in parallel are equivalent to or better than the 500,000-cir.mil conductor in carrying capacity, regulation and ability to clear secondary faults.

Assigning Feeder Connections

The primary feeder connections to the various transformers must be carefully selected to avoid, if possible, adjacent transformers being out of service when any one feeder is out. This is accomplished by interlacing the primary feeders. In a network plan where the transformers are spaced regularly and uniformly throughout the area the interlacing of feeders, such as A, B and C, may take the forms shown in Fig. 3. If there are five feeders, such as A, B, C, D and E, the interlacing may be as shown in Fig. 4. In actual interlacing problems the network units are seldom regularly spaced. However, the interlacing will be simplified by using some basic system, such as those illustrated in Figs. 3 and 4 and modifying the order of the feeder connections where it is necessary because of the absence of a transformer or the use of multiple units.

When the interlacing has been selected a map of primary feeder routings should be made. It may be possible to change some of the feeder connections to save some feeder cable and still retain good interlacing. In Fig. 2 the feeder connections, indicated by the letters A, B and C, follow a regular order along the line from *a* to *d*, except that one of the multiple units at *b* is connected to feeder A even though the transformer at *c* also is supplied from feeder A. This proved to be the best combination because of the location and interlacing of the transformers in the surrounding area. At *e* each of the three transformers is supplied from a different feeder, so that at least two of the units will be in service at all times.

By means of the preliminary estimates the location and ratings of transformers, feeder interlacing, secondary grid arrangement and secondary copper size are established so that a reasonable net work plan is established. This plan can then be simulated on the nework calculator on the basis of the impedances of the various circuit elements. The impedance of the primary feeders is usually low enough that its effect on the characteristics of the network is negligible. The impedance of a primary feeder is usually not larger than about one-tenth of the impedance of the largest transformer. Every case should be checked and if the primary feeder impedance exceeds the above value it may be necessary to consider the impedance.

Whether the primary feeder impedance is considered also will depend on the method of regulating primary voltage. If the drop in the primary feeders can be compensated for so that approximately constant primary voltage is maintained at the transformer primary terminals the primary feeder impedance should not be considered in any case. Due to the practical limitations of a network calculator it is difficult to cover the range of impedances represented by the primary feeders and loads in a network system. This range may be a thousand or more to one, and is another reason for not considering the effect of primary impedance in designing a network.

With the estimated plan set on the network calculator check studies can be made, along the lines to be described, to determine the accuracy of the preliminary estimates. It may be necessary to change transformer capacities or locations, feeder connections or secondary copper to avoid overloading or inadequate use of some elements of the network. Then, with a final plan determined, the characteristics of the network can be completely and accurately determined by means of the network calculator.

Network Calculator Studies

All network operating conditions can be investigated by proper arrangement of the various circuit elements on the network calculator. For example, when a given feeder is out of service, the associated transformer circuits are opened and the resulting load division among the remaining units is measured. The results of such measurements are shown for the typical area in Fig. 5 for each of the

[*Continued on page 61*]

Ranges and Water Heaters for the Long Pull

Tampa Electric registers exceptional gains through year-in, year-out company sales and promotion — Suggests numerous innovations, all tested by experience

M. T. ANTHONY,* Tampa Electric Company, Tampa, Fla.

DURING THE YEAR 1940 customers of the Tampa Electric Company purchased 1,577 electric ranges and 616 electric water heaters. This represented a 30.2 percent increase in ranges and a 34.4 percent increase in water heaters over the year before, which in itself had been a banner year. Saturation on ranges increased from 15.8 to 18.6 percent, or an overall increase of 2.8 percent, while saturation on water heaters increased from 6.1 to 7.2 percent.

The Tampa Electric Company believes that a load-building program should be planned not for one year but for many, and that full advantage should be taken of the cumulative efforts of past years. Therefore it has not changed the principles of its plan from year to year, but maintains a program in which there is a definite continuity. To accomplish its aims it does not indulge in intermittent special campaigns, for just as one band doesn't make a parade, one ad or one campaign doesn't result in anything permanent.

Experience in merchandising a product in the promotional period indicates that spasmodic effort is wasteful and does not bring results commensurate with the effort, as compared to a consistent day-in-and-day-out, month-in-and-month-out program.

Cold prospects for electric cookery are not developed into immediate buyers of electric ranges and water heaters through ballyhoo and circus methods, even though it is acknowledged that a certain amount of this procedure is required in any advertising or sales program to "clinch" the sale where desire has been created.

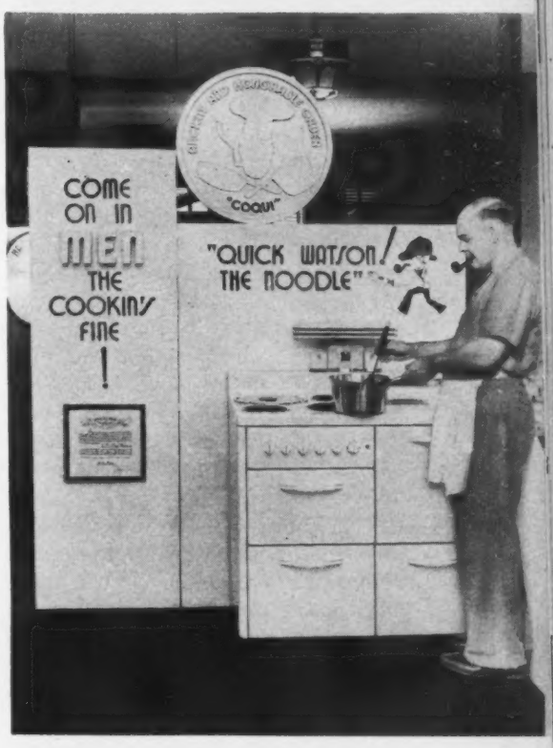
However, in its year-round program this company places more emphasis on a patient, intelligent story of the use of electricity than on high-pressure methods by which people are encouraged to buy on the spur of the moment, as we believe we thus obtain better satisfied users.

Sales Force

The first requirement of company salesmen is that they be good, substantial citizens. They must be respected by their fellow citizens and must have the ability to earn an income sufficient to give them an influential place in their respective communities. Because of the company's requirements in this matter the turnover is negligible—the average length of service of the present group being slightly more than eight years.

Each salesman is assigned a district selected as to size so that he can give us good representation, and wherever possible he lives in his own district. In the districts largely populated by people of Latin descent the salesmen are chosen for their ability to talk in the native tongue of these customers.

Group consultations are held each morning, at which each salesman turns in a report of his previous day's work. A large progress chart showing each salesman's monthly and yearly quota is prominently displayed and each man's progress is posted daily, creating a spirit of friendly rivalry that inspires persistency in sales and consistent selling throughout the year.



NOT A NATIVE TAMPAN but a life-like cardboard cut-out of the customer, displayed in the utility show window, stops sidewalk traffic

It is interesting to note that the quotas were exceeded both during 1939 and 1940.

The method employed in securing prospects for the salesmen is a continuous systematic check of the meter records to determine those customers whose increasing use of electricity makes them practical prospects for electric cooking and water heating.

Purchasers of electric refrigerators are logical prospects for electric ranges, particularly after they have

* General sales manager.

ANOTHER sure-fire attention getter is this animated display of electric water heaters in the show window of Tampa Electric

completed their payments. The company watches this source of prospects closely and as soon as the refrigerator has been paid for a letter is sent to that customer thanking him for his promptness in paying and for the privilege of doing business with him. At the same time the company points out that the use of the refrigerator has brought the customer into the lower brackets of the residential rates and that the electric range would therefore be very economical to operate and be another step toward a modern all-electric kitchen.

A continuous check on homes having unused range wiring is maintained. As soon as an electric range user moves the salesman in that territory is notified so that contact will be made with the next occupant of that house. *A $3 bonus is paid to a salesman or a dealer in cases where no additional wiring is required for installation of the range.*

Contacts with new range and water heater users are carefully watched and salesmen are required to call back the day after the equipment is installed, and then again at regular intervals. In this manner they secure additional prospects from actual users.

Roaster Trade-in

Another method of obtaining prospects for electric ranges is through the sale of electric roasters. When a prospect is not entirely sold on the idea of buying a range, the company endeavors to place a roaster in that home, knowing that this customer may be influenced to purchase a range because of actually experiencing the advantages of electric cookery. If the customer purchases a range within twelve months after purchasing a roaster, the roaster may be returned and payments made will be applied on the purchase price of the range.

The management assumes a definite responsibility in directing the salesmen's efforts toward customers who are the most likely to be prospects for electric ranges and water heaters and feels that it is the management's responsibility to eliminate the need for cold canvassing.

This has a twofold purpose—first, to keep up the morale of the salesman and, second, to conserve the salesmen's time for more productive efforts.

The Tampa Electric Company recognizes the importance of the dealers in its load-building program and although it follows an aggressive sales policy it also provides for a liberal policy of cooperation with them.

Its plan includes a promotional allowance of $20 for each electric range the dealer sells, provided it does not replace one already in operation. To be eligible for this allowance the dealer must display electric ranges in his place of business, do a reasonable amount of advertising and have an active sales force.

Dealers are placed on an equal footing with the company in making range and water heater sales. This is done by the company's agreeing to finance the dealers' paper (paying cash for a range or water heater sold and then making collections in the regular manner), by making available to the dealer the same plan of installation as the company uses, and by assigning company's home economists to demonstrate ranges which the dealers sell.

As evidence of the effectiveness of this cooperative plan, dealers' range sales showed an increase of 85 percent during 1940 over the previous year.

Home Service

The company recognizes the fact that there is no substitute for a satisfied customer and it insists that fully as much attention be given the customer after the sale has been made as is given during the process of making the sale. To do this only graduate home economists are employed, some of whom devote their time to home instruction and others to lecture demonstrations.

One feature of this department which has been very helpful both in actual selling and in creating good will is the establishment of three demonstration kitchens and party rooms in different communities under the name of "Leisure House." Cooking schools are held in each of these Leisure House kitchens at regular intervals and are attended by interested audiences of range users and prospective purchasers. In addition to the regular cooking schools the company also conducts training courses in Leisure House for young matrons, brides, girl scouts, business women, and other special groups.

A maid's school is held one evening each week for the purpose of instructing colored servants in the correct and economical use of electrical equipment as well as for educational work generally.

The company's home economists work in close cooperation with county demonstration agents and carry out a continuous program of educational work among the rural customers. They also work in close association with home economic instructors in the schools and are frequently given opportunity to give instruction before groups of students who are future home makers and potential users of electric equipment.

Sales promotion of ranges and water heaters centers chiefly around three types of advertising, all based upon the customer doing the talking for the company rather then the company's claims about what electricity will do and what it costs.

1. *Women's Testimonials.*—This type of newspaper advertisement contains photographs of women customers in their electric kitchens, together with their signed statements as to what they think of electric cookery, etc. Nothing is paid for these testimonials. One of the purposes of this type of advertising is to show by actual experience that all-electric service costs no more, and sometimes less, than a combination of services. It has proved to be an important factor in obtaining our range and water heater sales volume and has also been helpful from an institutional standpoint. Recently this same type of testimonial advertising has been incorporated in a series of fifteen-minute radio broadcasts. Each week a woman customer tells of her experiences with all-electric service over the local radio station.

2. *COQUI (He-men Cooks).*—This type of newspaper advertising was originated two years ago and has since developed a substantial local organization of boosters for electric ranges. It is designed to attract men who cook as a hobby. Here again this type of advertising contains a photograph of the candidate for the "Ancient and Honorable Order of Coqui," preparing his favorite recipe on an electric range, together with his statement about electric equipment and a few facts about himself and his business. The enthusiasm with which these men talk about and display their diplomas, which contain their names and the names of their recipes, attracts the attention of their business associates, who in turn become interested in the story of electric cooking.

3. *Builders' Cooperation.*—The company cooperates with builders constructing groups of new homes, or in the development of subdivisions, by publicizing both the builder and his new homes, providing complete wiring is installed for all-electric kitchens in each home to be constructed. The advertising generally contains photographs of the homes under construction, together with a statement by the builder or developer as to his reasons for selecting all-electric service. This gives the company a rather favorable entree when the homes are finally completed and sold.

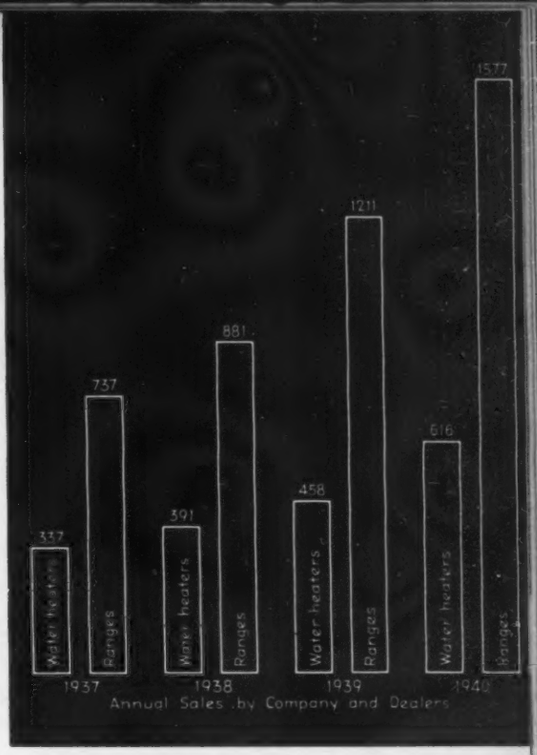
Increase in Usage

As a result of our load-building program the company's average twelve-month domestic kilowatt-hour consumption increased from 777.9 kw.-hr. as of December 31, 1939, to 840.3 kw.-hr. as of December 31, 1940. This represents an increase of 62.4 kw.-hr., or 8 percent increase.

The Tampa Electric Company takes the long view that residential load should be developed on a basis which will yield a net profit over a period of time.

We believe our sales and advertising organizations perform two functions, merchandising and promotional selling, which are so intermingled that only arbitrary division between expenses for the two purposes can be made. We consider the selling of ranges and water heaters to be promotional as yet, whereas the selling of lamp bulbs, for instance, is a strictly merchandising operation. Consequently, even if an equitable apportionment of expenses could be made to each sales item, there would be little significance in any ratio this expense might bear to the sales results either in dollars or kilowatt-hours for any one month or year.

In other words, sales effort made in the past is bearing fruit now and the cumulative sales effect of this year's effort and that of preceding years should continue to be felt in years to come.



COMPANY SALES and dealer sales (1) push range and water heater sales to successively higher levels; (2) improve the water heater-range ratio

Secondary Network Planning—II

[*Continued from page 58*]

three feeders out of service in turn. For systems having less than about six feeders experience indicates that the interruption of only one feeder at any time is the worst condition that need be anticipated. Therefore, networks are designed to carry the total peak load on any combination of one less than the total number of feeders.

The d.c. network calculator is used for designing a network because it is simpler and faster than the a-c. type. Comparative studies on both types of calculators have shown that the results from the d.c. calculator are practically equivalent to those from the a.c. device when impedance is used to determine settings on the d.c. device. A recent comparison of measured values in an actual network with values determined from a corresponding d.c. network calculator set up showed that results from a miniature system agree closely with results under similar conditions in an actual network system.

From the network calculator results the worst load in each of the various elements for any emergency operating condition can be determined and tabulated as shown in Fig. 6. For example, the maximum current in secondary main *b–c* occurs when feeder A is out as shown in Fig. 5a and the maximum load on transformer *j* is when feeder C is out as in Fig. 5c.

The voltage regulation at points in the network is summarized in Fig. 7 for the typical area. The limitations for the regulation on the network will depend on the quality of service the system is to provide. A common voltage regulation range for normal operation with all feeders in service is plus or minus 3 or 3.5 percent at the services. This permits a total variation of 5 or 6 percent from no load to full load if allowance is made for 1 percent drop in the primary feeder between the first and last transformers on the feeder. For emergency conditions when a feeder is out of service for a short time poorer regulation can be tolerated; the total voltage variation from no load to full load should not be more than 10 or 12 percent for the emergency condition.

Fault Study

Three-phase faults are simulated at the various points in the network to determine the ability of the network to clear secondary faults. Examples of these fault currents are shown in Fig. 8 for faults at two points in the typical area. A complete fault study gives two values of fault current for each section of main—one for a fault at each end. The minimum one of these two values is the limiting condition. These minimum values can be summarized for convenience in the form shown in Fig. 9 for the typical area.

Pole Strength Requirements Quickly Determined

Slide rule method saves time in field inspection — Typical application described from New England Power Association practice

RAYMOND S. NORBERG, Narragansett Electric Company, Providence, R. I.

BOTH from the standpoints of the power company and of the inspector, pole inspecting has always been a tedious task. Thousands of poles to cover, thousands of man-hours per year are involved, each pole being much like the one before, but just enough different to require separate calculations. With guys here, transformers there, different wires and different loading, there is always a calculation to be made if loads are to be properly determined so that the last bit of useful life can be obtained without sacrifice of service. To meet this situation a new pole-computer slide rule, which greatly simplifies the procedure of determining pole strength requirements, has been accepted by the standards committee of the New England Power Association. The slide rules have been in use for more than a year and have proved satisfactory.

These rules are made about 8½ in. long of celluloid and are light and flexible, thus not being easily subject to breakage. Purchased in quantity, their cost is low and replacement small.

Although the slide rule was designed primarily for pole inspection, it may also be used to determine dead-end and angle loads, as well as the class of poles required for replacement of existing poles, or for new construction. Due to the simplicity, accuracy and speed of determining the required information, the rule has found a definite place in both engineering and distribution departments of our organization.

Wire Load Unit

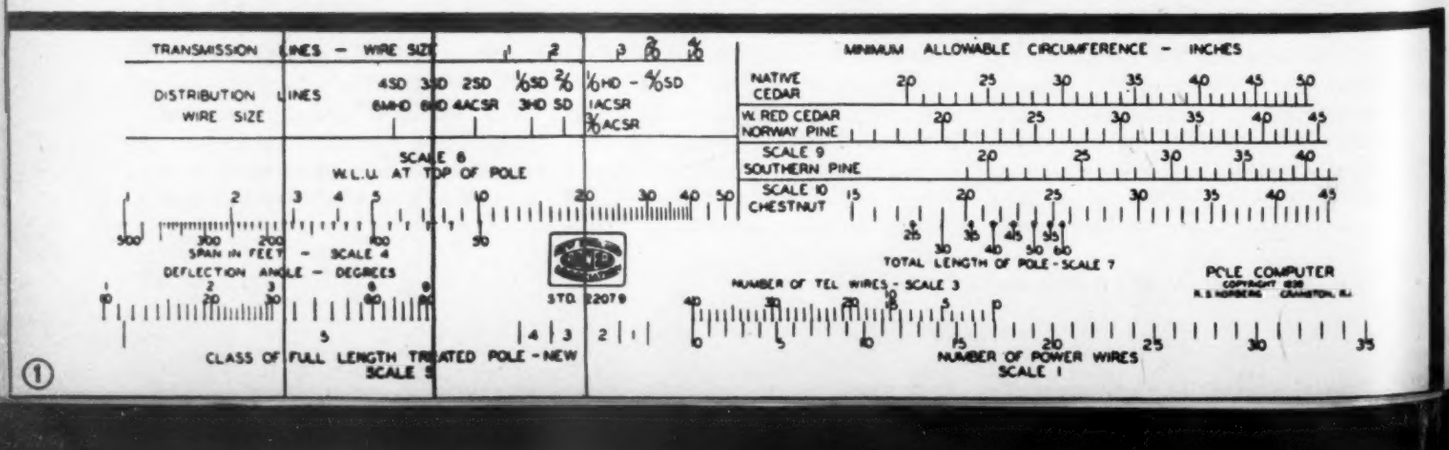
The basis of all loads used on this slide rule is a wire load unit (W.L.U.) which is an arbitrary load of 100 pounds at the top of the pole and is the approximate equivalent of the wind load on 100 ft. of ice-covered wire. The following example shows the method of operation. The objective is to find the minimum allowable circumference of an unguyed 35-ft. chestnut pole loaded as follows: (a) Four No. 3 TBWP power wires; (b) two No. 6 TBWP power wires; (c) eight open telephone wires; (d) 7-deg. deflection angle in the line; (e) 130-ft. average length of adjacent spans; (f) one transformer.

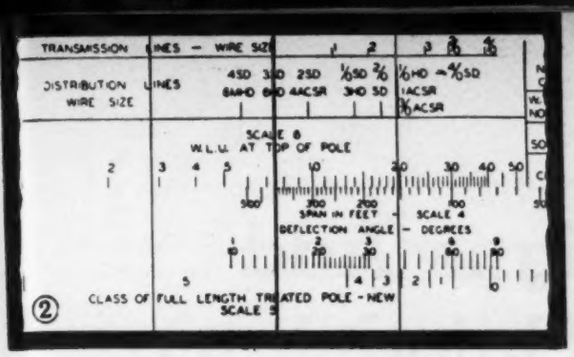
FIG. 1—First, to determine the angle load set the slide indicator on No. 3SD, on the distribution wire scale, and directly below on scale 6 read 7.5 W.L.U. (750 pounds). This is the dead-end load for one No. 3 TBWP wire.

FIG. 2—Then, opposite 7.5 on scale 6, set 400 on scale 4 (see footnote[1]), and opposite 100 on scale 4 read 30 W.L.U. (3,000 pounds) on scale 6. This is the dead-end load for four No. 3 TBWP wires.

FIG. 3—Then move the slide indicator to 7 on the deflection angle scale and directly above on scale 6 read 35. For angles less than 10 deg. the angle load will be 0.1 of the reading on scale 6. Therefore in this case the corrected reading will be 3.5 W.L.U. (350 pounds), which is the resultant angle load of the four No. 3 TBWP wires.

[1] Scale 4 is also used to multiply the number of wires when required to find the angle or dead-end; load; *i. e.*, the 400-ft. graduation is used as four wires, the 70-ft. graduation as seven wires, etc. When multiplying by more than five wires, the result obtained on scale 6 must be multiplied by 10.




TRANSMISSION LINES - WIRE SIZE
DISTRIBUTION LINES WIRE SIZE
SCALE 6
W.L.U. AT TOP OF POLE
SPAN IN FEET - SCALE 4
DEFLECTION ANGLE - DEGREES
CLASS OF FULL LENGTH TREATED POLE - NEW SCALE 5
2

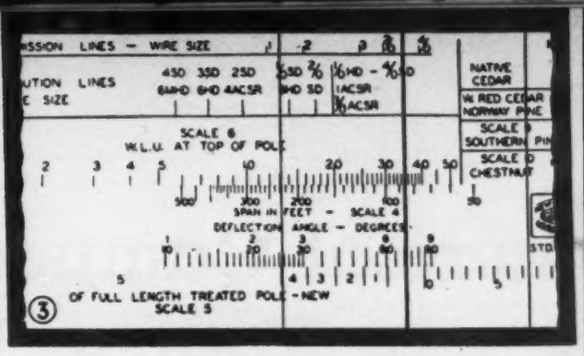

SCALE 6
W.L.U. AT TOP OF POLE
SPAN IN FEET - SCALE 4
DEFLECTION ANGLE - DEGREES
NATIVE CEDAR
W. RED CEDAR NORWAY PINE
SCALE 9 SOUTHERN PINE
SCALE 10 CHESTNUT
OF FULL LENGTH TREATED POLE - NEW SCALE 5
3

TABLE I

WIRE LOAD EQUIVALENTS FOR SCALE 6

DESCRIPTION WIRE OR CABLE	SCALE 1
POWER WIRE UP TO 3/0 TBWP	1
AERIAL POWER CABLE	4
POWER WIRE 3/0 TBWP	1.2
POWER WIRE 500 MCM & LARGER	1.5
HEAD GUY	1
	SCALE 3
TELEPHONE CABLE ALL SIZES	4
TWISTED PAIR IN RINGS	4

TABLE II

EQUIVALENT LOAD UNITS FOR SCALE 6

DESCRIPTION OF ATTACHMENTS	SCALE 6
STREET LIGHT BRACKET	1
TRANSFORMER	1
SERVICE WIRES & CABLES ONE SIDE ONLY EACH WIRE	1
EACH CABLE	2

BOTH SIDES SUBTRACT THE NUMBER OF WIRES ON THE LARGER SIDE FROM TWICE THE NUMBER OF WIRES ON THE SMALLER SIDE IF THE RESULT IS POSITIVE GO DOWN THE SCALE THAT MANY SPACES IF NEGATIVE GO UP
NOTE - EACH CABLE EQUALS 2 WIRES

TABLE III

TROLLEY CONTACT CONDUCTORS

DESCRIPTION	SCALE 6
SUSPENSION STRAND	
WITH 1 TROLLEY WIRE	3
WITH 2 TROLLEY WIRES	6
WITH 4 TROLLEY WIRES	10
BRACKET	
WITH 1 TROLLEY WIRE	1.5
WITH 2 TROLLEY WIRES	3

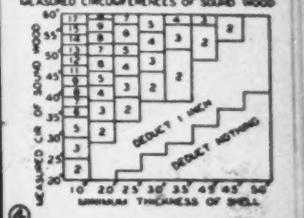
SCALES 9 & 10
SUSPENSION - ADD 2° EACH WIRE 20° TO 30°
SUSPENSION - ADD 1° EACH WIRE ABOVE 30°
BRACKET - ADD 1° EACH WIRE 20° TO 30°
BRACKET - ADD ½° EACH WIRE ABOVE 30°

TABLE IV

CIRCUMFERENCE REDUCTIONS FOR POLES WITH EXPOSED POCKETS

DEPTH OF POCKET INCHES	DEDUCTIONS IN INCHES TO BE MADE FROM MEASURED CIRCUMFERENCES FOR POCKET WIDTHS OF 1	2	3	4	5	6	7	8
1	1	1	2	2	3	3	4	5
2	1	2	3	4	5	6	7	8
3	1	2	4	5	6	8	9	11
4	2	3	4	5	7	9	10	13
5	2	3	4	6	7	9	11	—

POLES WITH HOLLOW HEARTS
DEDUCTIONS IN INCHES TO BE MADE FROM MEASURED CIRCUMFERENCES OF SOUND WOOD



Using the same procedure for the two No. 6 TBWP and the eight open telephone wires (four open telephone wires assumed to be equivalent to one No. 6 M.H.D. power wire), the resultant load for these wires is found to be 2.7 W.L.U. (270 pounds), which, added to 3.5 W.L.U., for the four No. 3 TBWP wires, equals 6.2 (620 pounds), the total angle load produced by all the wires.

Wind Load

To determine the wind load we proceed as follows:

FIG. 4—From Table 1 (four tables are printed on the back of the rule) it is noted that for power wires of No. 00 or smaller, each wire has a wire load equivalent of one. Therefore the six power wires in this problem have a wire load equivalent of 6.

FIG. 5—Now, opposite 6 on scale 1, set 8 on scale 3, and opposite the 0 on scale 3 we read 10.7 on scale 1, which is the total combined load of the power and telephone wires expressed in W.L.U.

FIG. 6—This total, 10.7, is then transferred to scale 6. Opposite 10.7 on scale 6 set 130 (the average span in feet) on scale 4, and opposite 100 on scale 4 read 13.8 on scale 6. This is the number of W.L.U. produced by the wind on the wires. Now add 1 for the transformer (see Table 2 and footnote[2]) on scale 6, which gives a total of 14.8, the total wind load on the pole in W.L.U.

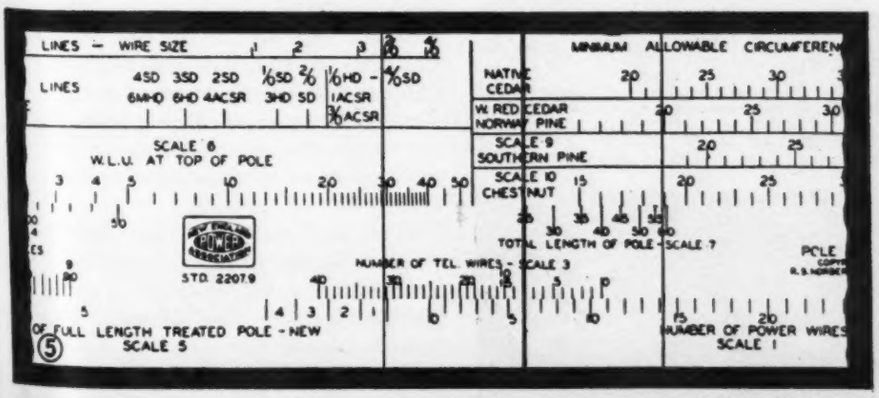
The angle load, which was found to be 6.2 W.L.U. in the example, is then added to the total wind load of 14.8 W.L.U., which gives a total load on the pole of 21 W.L.U.

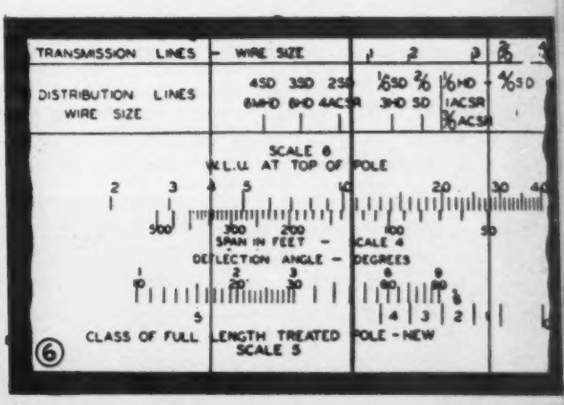
FIG. 7—Then, opposite 21 on scale 6 (Fig. 8), set 100 on scale 4 (100 is used merely as an indicator and has no value other than this in this particular operation), and opposite 35 on scale 7 (Fig. 7) read 33.5 on scale 10, for chestnut poles, which is the minimum allowable circumference required to support this given load.

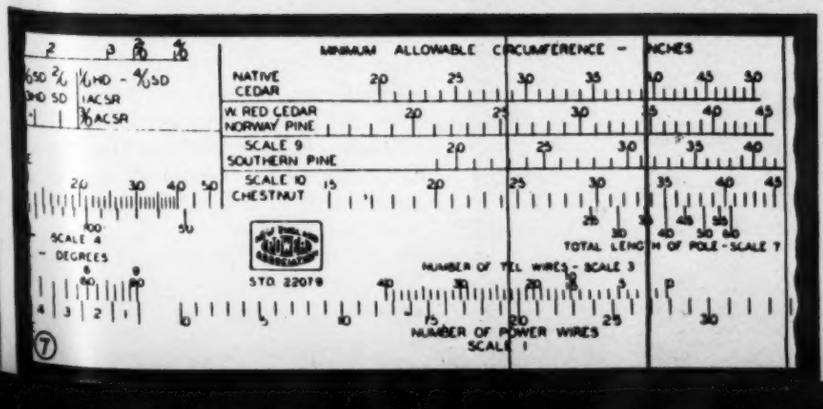
FIG. 8—If a new pole is under consideration, then directly below 21 on scale 6 read 2 on scale 5, which is the class of new pole required.

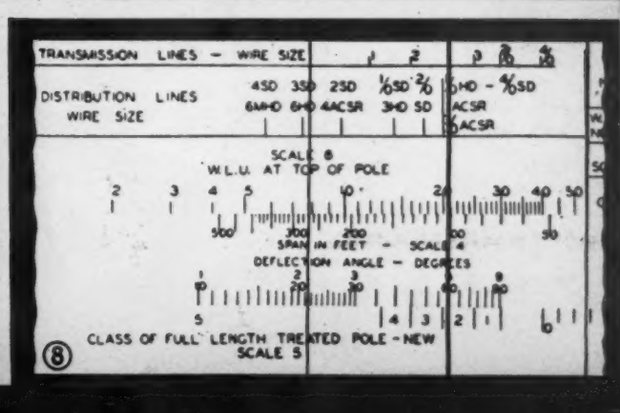
No attempt has been made here to describe pole inspection routine or the derivation and values of the scales incorporated in the slide rule, the objective being to show its application to the existing construction and pole inspection standards as practiced by the New England Power Association.

[2] The attachments given in Table 2 should never be multiplied by the length of span as the wind load on these attachments bears no relation to the length of span.


MINIMUM ALLOWABLE CIRCUMFERENCE
NATIVE CEDAR
W. RED CEDAR NORWAY PINE
SCALE 9 SOUTHERN PINE
SCALE 10 CHESTNUT
SCALE 6 W.L.U. AT TOP OF POLE
TOTAL LENGTH OF POLE - SCALE 7
NUMBER OF TEL. WIRES - SCALE 3
NUMBER OF POWER WIRES SCALE 1
OF FULL LENGTH TREATED POLE - NEW SCALE 5
5


TRANSMISSION LINES - WIRE SIZE
DISTRIBUTION LINES WIRE SIZE
SCALE 6 W.L.U. AT TOP OF POLE
SPAN IN FEET - SCALE 4
DEFLECTION ANGLE - DEGREES
CLASS OF FULL LENGTH TREATED POLE - NEW SCALE 5
6


MINIMUM ALLOWABLE CIRCUMFERENCE - INCHES
NATIVE CEDAR
W. RED CEDAR NORWAY PINE
SCALE 9 SOUTHERN PINE
SCALE 10 CHESTNUT
TOTAL LENGTH OF POLE - SCALE 7
NUMBER OF TEL. WIRES - SCALE 3
NUMBER OF POWER WIRES SCALE 1
7


TRANSMISSION LINES - WIRE SIZE
DISTRIBUTION LINES WIRE SIZE
SCALE 6 W.L.U. AT TOP OF POLE
SPAN IN FEET - SCALE 4
DEFLECTION ANGLE - DEGREES
CLASS OF FULL LENGTH TREATED POLE - NEW SCALE 5
8

Commercial Campaigns Add 13 Kw. per Year in Philadelphia

Eight-year program of Philadelphia Electric sells $91,000 of equipment in three latest campaigns — Brings in $105,062 of new revenue

G. T. HIBLER, Philadelphia Electric Company, Philadelphia, Pa.*

DR. FREE AT WORK—A simple relay in the deep fryer circuit, switches red light on when current is flowing, switches Dr. Free sign on when thermostat cuts off current. Very convincing sales tool

WINDOW KITCHEN—Typical of many Philadelphia installations is this one of 12½ kw. This installation has worked out so well that the customer has expanded next door and the company is laying out a complete window kitchen consisting of cafe type range, meat grill, fryer and coffee-maker.

THE THREE latest "step-up" commercial cooking campaigns of Philadelphia Electric Company have resulted in the sale of 2,048 appliances with a retail value of $91,332. Even more important, from our company's standpoint, is the fact that the above equipment added new load of 4,152 kw. and added new revenue per kw. of $25.30 per year, or a total of $105,062.

These results have come from a program conceived eight years ago when a few salesmen instituted a survey of the load building potential of the commercial cooking market, saw the possibilities in terms of added kilowatt-hour sales and worked up a logical selling plan.

The original personnel consisted of four salesmen, whose responsibility it was to create, economically, new commercial uses for electricity in the Philadelphia area. The program was unique since these men were not directly selling equipment, but promoting its greater use to produce the desired result—increased kilowatt-hour usage.

Let's call this plan the Result Plan—from which all profited. Graphically, it consisted of three interdependent factors—the customer, the manufacturer-dealer and the utility company—all three being eager to find ways to profit.

During the ensuing four years the demands from the market made it necessary to develop a system of closer coverage, thereby getting more profitable contacts—more personnel. Sales calls were analyzed, logical

* Retail sales promotion.

classes of prospects were identified and a better ratio of sales per call was the result. Since the character of the selling was unusual, special training courses took place. These courses covered many angles of the various commercial businesses, familiarizing the salesmen with the more important characteristics of these businesses and making it simpler to discover proper applications for added electric usage. Such training paid dividends as the salesmen became more effective and the prospective buyer gained confidence much quicker when he realized the representative had a thorough knowledge of his problems.

As this classification of customers continually increased, until now there are 123,428 customers, it has been necessary to create new territories and assign additional salesmen to them. Today's representative is well equipped to discuss intelligently lighting, ventilation, air conditioning, heating and cooking, and offer solutions.

TYPE of direct mail used by Philadelphia Electric

Pep-up sales checks by pepping-up appetites with
Electric COUNTER COOKING
Put new life in your short-order business with Electric counter cooking
PEP-UP PROFITS WITH PEPPED UP APPETITES
Ever try sizzling platters? Steaks smothered in onions or juicy lamb chops with hashed brown potatoes served sizzling hot? The very sound entices others to try 'em.
There's no trick to pepping up appetites—and customers' checks—with these money-making specialties when you use an electric grill. Just one of the several modern Electric Counter Cooking appliances that prepare tastier foods . . . serve more . . . cut waste . . . and cost little to use. They're "musts" in the profitable operation of any restaurant and lunch counter business.
Without obligation to you we shall be glad to send a trained representative to explain how you can profit by the use of Electric Counter Cooking equipment.
Take Advantage of This FREE Service!
Telephone your nearest Philadelphia Electric Company office and ask for Retail Sales.
ASK US TO SHOW YOU HOW!

The Sales Plan

The sales plan is illustrated particularly well by the cooking program, where considerable effort is applied to the smaller restaurants to encourage increased use of electric cooking equipment.

The restaurant operator is developed by the retail salesman, who has equipped himself with all pre-approach data available. Through suggestion, presentation of advantages, visual proof and other users' testimonials he gets the customer's interest and invites him to a special display room located in the main office of the company.

This demonstration room is a modern, complete luncheonette, using all types of electric cooking appliances. The equipment is not only displayed but is actually demonstrated. Here the prospect sees and tastes the foods cooked electrically. Such a method has produced unusual results, as, for example, ten sales from fourteen demonstrations! The room is large enough also to accommodate groups, an example being members of a county tavern-keepers' association who sought best ways of preparing and selling food in their taverns.

Should the trip to the demonstration room be impractical, the equipment is brought to the customer. "When Mahomet can't come to the mountain, then the mountain comes to Mahomet." This is handled by a special demonstration truck, equipped to install any electric cooking device right in the customer's kitchen. Here Mr. Prospect can count the profits for himself in the use of electric cooking.

The fuel savers—the thermostats, are vividly brought to the prospect's attention by a special instrument called "Dr. Free." This was developed by a cooking specialist of the Philadelphia Electric Company. This instrument visually shows the customer when he is using electric service and when he actually cooks his food—free.

Mr. Prospect has now progressed to a buyer stage, so he desires to purchase this equipment. Should he favor one local dealer over another he has his choice of purchasing from that establishment, and the salesman notifies the dealer to call for a waiting order. The dealer cooperates to the fullest, since he makes more sales at a much reduced sales expense.

Should Mr. Buyer have no dealer preference, his "decision to buy" is relayed directly to the manufacturer's representative, who designates the dealer. Again more sales at reduced sales costs. This close cooperation with manufacturer and dealer salesman results in frequent requests for the retail salesman's assistance to create a better entree with the customer and a more satisfactory transaction results.

Periodic Stimulation

As in every sales plan, periodic stimulation is inserted. This takes place each fall, when vacation fancies fall before the appetite-stimulus of brisk, busier days. Special bonuses, collectible in time for Christmas shopping, are offered to both utility and dealer salesmen. Quotas are also assigned to retail salesmen to encourage the competitive spirit. Just preceding these activities, the company's advertising department does its share.

	Units Sold	Kw. Sold	Estimated Annual Revenue	Estimated List Price
Coffee makers ..	938	1783.5	$47,383	$39.237
Fryers	210	1030.4	26,479	22,668
Grills	146	210.3	5,668	4,626
Waffle bakers ...	99	155.5	4,208	3,421
Toasters	164	361.9	7,279	7,961
Griddles	17	50.3	1,359	1,106
Miscellaneous ...	473	599.7	12,686	12,313
	2,048	4151.7	$105,062	$91,332

Direct mail pieces of the catch-the-eye, get-the-action nature are prepared and mailed to special live and closely followed prospect lists. Material prepared by the Commercial Electric Cooking Council is also used. In this way the prospect is told of how he can do a better cooking job and make more money. This sales barrage helps to make him more receptive when the retail salesman makes his first call.

"The proof of the pudding" is presented in the table above through cumulative results of the three latest fall campaigns, held in 1938, 1939 and 1940.

This "Result Selling" plan has been successful, in our opinion, and therefore the plans for the future remain basically the same. Looking to the future, greater emphasis will be put on the following considerations:

Expanded services to customers.

Increased educational activities for retail and dealer salesman.

More customer education.

Effective sales plan plus added emphasis on "demonstration room selling."

Concerted efforts for cooperation with manufacturers and dealers.

Emphasized heavy-duty cooking equipment promotion.

Dealer displays and sales helps.

A continuous twelve months' program of cooking promotion.

All of the above when annexed to the basic triangle of *profit*, for buyer, for dealer and for the utility, will undoubtedly show even better results in the future for Philadelphia's 123,428 commercial customers.

First Forced Feed Circulation Plant

[*Continued from page* 54]

tor drives are used on the induced-draft fans. High-pressure piping between boiler and turbine will be Grinnell 12¾ in. outside diameter with walls 1.7 in. thick of forged carbon molybdenum steel, A.S.T.M. specification A-206-39-T. Each gate valve (Crane) will be driven by a Cutler-Hammer TNG motor-operating unit, with two control stations, one near the valve and one at boiler room floor level. All joints will be welded and Gamma-rayed. A pressure reducing and desuperheating connection will be installed between the high pressure steam line and the exhaust line from the turbine to the reheater. Safety valves in the 400 psi.; turbine-reheater line protect the unit from rise in pressure should a gate valve be closed.

Hagan combustion control equipment is provided and will be used to regulate the rate of supply of coal or fuel oil individually or both simultaneously, and of air for the main burners, also to adjust induced-draft fan operation for best efficiency and required furnace draft. Control of forced- and induced-draft fans will close a damper if one fan should go out of service, the other continuing to operate. If one set of forced- and induced-draft fans should trip out under load a limit device will immediately reduce the load on the boiler to that which safely can be cared for by the remaining fans. If both induced-draft fans should trip out the dampers of both will open wide and the fuel supply automatically shut off. Hagan steam temperature control is also provided to operate the dampers at the economizer gas exit, which in turn varies the amount of superheater area swept over by the gases. When burning coal it is expected that 960 F. maximum will be maintained at all steam outputs above 480,000 lb. per hour, but with oil fuel the auxiliary burners will be required.

To guard against excessive pressure in the feed pump discharge line a Bailey Bourdon tube installation is to be made which will reduce the turbine speed at about 100 psi. above maximum discharge pressure, and a second Bourdon tube will function to trip the feed pump turbine overspeed governor if the control equipment fails completely.

When the topping unit is delivering 25,000 kw. the boiler will supply 620,000 lb. per hour, of which about 615,000 lb. will be exhausted from the turbine at 400 psi. and 603 F. A portion of this (77,500 lb. per hour) will be used in two Alco cross-over heaters in parallel as a final stage. The remainder (537,960 lb. per hour) will go to the reheater in the boiler setting, where its temperature will be raised to 760 F. To reduce this to 750 F. tempering steam taken from the saturated zone of the cross-over heaters will be admitted at the reheater discharge. Of the reheated steam about 53,000 lb. per hour will be used to drive the high-pressure boiler feed pumps, the remainder (about 500,000 lb. per hour) passing into the header supplying the two existing units. This will suffice for generating about 47,800 kw.

Electrical Features

The new turbo-generator is a General Electric 3,600-r.p.m. hydrogen-cooled machine rated at 28,571 kva., 0.7 lagging power factor, 14 kv. No step-up transformers are being added at this time. In order to handle the increased output of the station the capacity of the original transformer banks is being raised 30 percent by adding blower equipment on the radiators to give a total rating of about 107,250 kva. No circuit breaker was required between the bus section fed by the generator of the topping turbine and the transfer bus, as this machine always delivers energy in connection with one or both of the lower pressure units and is provided with a breaker between its windings and its own bus section.

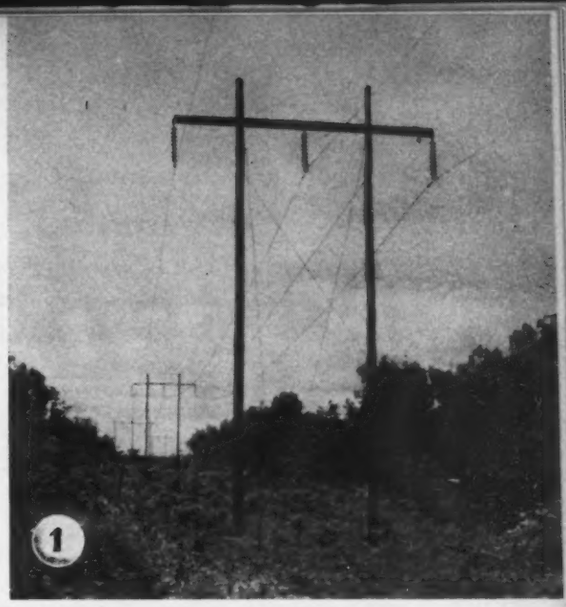
Eight of the existing G.E. (type FH-206) 14-kv. oil circuit breakers in the station with a rupturing capacity of about 500,000 kva. have been rebuilt to provide a rupturing capacity of 1,000,000 kva. on account of the additional generating capacity provided. The work includes modernization parts, increased current-carrying capacity contacts and subcell disconnects. High-speed operating mechanisms have been provided, with the addition of copper to transformer circuits in certain locations and the silver plating of contacts to raise the current-carrying capacity of connections and disconnecting switches in necessary cases.

The engineering design and construction at the Somerset station is being handled by the Stone & Webster Engineering Corporation, Boston.

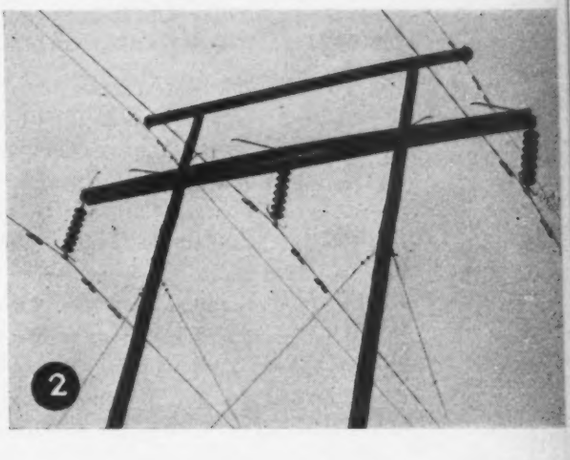
New Southern Line Completes 555-Mile Loop

Mississippi Power 110-kv. line features double-plank crossarms on H-frame creosoted pine structures—Overhead ground wires augumented by arcing gaps for lightning protection

A. J. WATSON, Transmission Engineer, Mississippi Power Company



ADDING a link to close its power loop, Mississippi Power last year completed the 68-mile, 110-kv. transmission line from Gulfport north to Hattiesburg. With the completion this year of the Mobile steam plant of Alabama Power, this line will be placed in permanent operation, closing a 555-mile loop that starts at Jordan Dam, Ala., winds through Meridian, Laurel, Hattiesburg and Gulfport, Miss., crosses over to Mobile, Ala., whence it returns to Jordan Dam directly over one line and also to Jordan Dam from Mobile Dam over a line through Mitchell Dam. Details are presented in the pictures.

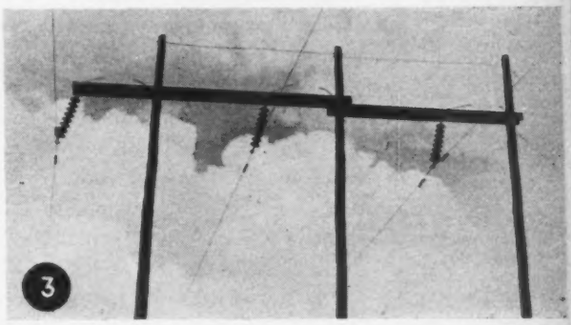


1. TANGENT structures at road crossings use nine insulators instead of seven as do standard suspension structures and 3 x 10-in. crossarms instead of 3 x 8's. It is guyed away from the crossing. (At railroad crossings nine inulators are used and 6 x 8-in. crossarms.) Since this picture was taken overhead ground wires have been clamped to the tops of the poles, 5 ft. above the crossarms supporting the conductors. Private right-of-way, on which the line was built, was cleared in such a manner that any tree falling toward the line would miss the outside conductor by 10 ft.

2. OVERHEAD ground wires are supported on 6 x 6-in. x 24-ft. crossarms in the mile sections north from Gulfport and south from Hattiesburg. Like others in the 10-mile area north from Gulfport, this structure is storm guyed for hurricane loading.

3. THREE-POLE structures instead of conventional H-frames, are used at angles. This type is used for angles up to approximately 10 deg.

4. PULL-OFF structure of approximately 89 deg. is representative of those used on angles from 10 to 90 deg., except that on those within this range, but less than 60 deg., only one suspension insulator clamp and no yoke are used. Thirteen insulators per string are used, since there are no arcing gaps in the guys or down leads.



Design Data for Gulfport-Hattiesburg 110-Kv. Line

Poles—Primarily 50-, 55-, 60- and 65-ft., Classes 3 and 4 Southern yellow pine H-frame structures; creosote-treated for 10 lb. per cu.ft. retention.

Crossarms—Double plank, using Hubbard hardware; chiefly 3 x 3-in. x 32 ft., with 3 x 10-in. x 32-ft. timbers at highway crossings, two 6 x 8-in. x 32-ft. timbers at railroad crossings. Same type of wood and treatment as poles.

Conductors—266,800-circ.mil A.C.S.R., strung to two tensions: From Gulfport 10 miles north, to withstand hurricane loading at 5,625 lb. tension, no ice, 20-lb. wind, 50 deg. F. Beyond this, to Hattiesburg, strung for light loading, 4,420-lb. tension, no ice, 12-lb. wind, 30 deg. F.

Grounds—Overhead ground wire is ⅜-in. high-strength galvanized steel strand having ultimate strength of 10,800 lb. Mile section south from Hattiesburg substation is strung for light loading, 3,800 lb. tension, no ice, 12 lb. wind at 30 deg. F. Mile section north from Gulfport substation is strung for hurricane loading, 4,200 lb. tension, no ice, 20-lb. wind at 60 deg. F. Galvanized steel counterpoise strip installed at all structures with overhead ground wires where tower footing resistances are not already 15 ohms or less. Arcing gaps installed on crossarms of tangent structures, with point-spacing of 28 in.

Guys—Made with ⅜-in. high-strength galvanized steel strand. No insulators installed in any guys.

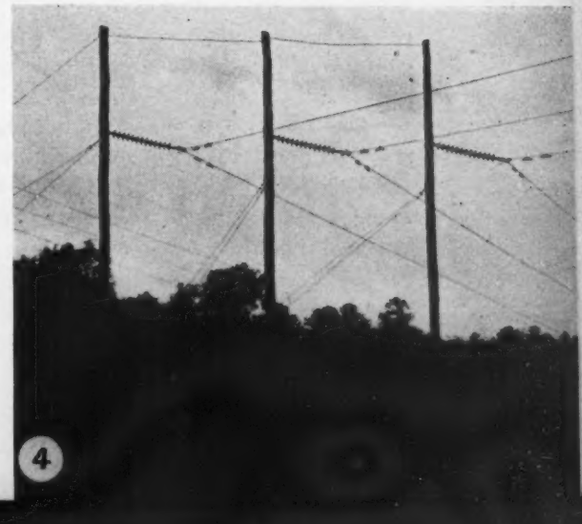
Anchors—10-in. minimum diameter, 6-ft. long creosoted pine logs.

Insulators—All strain and suspension insulators are ball-and-socket types, 10-in. in diameter, 5¾ in. spacing, have an M. & E. rating of 15,000 lb.

Insulation—Combined porcelain and wooden insulation calculated to give line an insulation level of approximately 800 kv. with 1½—40 wave or 1,400 kv. with a ½—40 wave.

Span Length—Longest span is 1,420 ft. and average is 865 ft.

Addenda—Stockbridge dampers are installed on both conductors and overhead ground wires. One 161-kv. line-sectionalized switch installed on steel tower. The utility contemplates installation of automatic oscillograph at Gulfport substation in 1941. By using determining values of ground current in the neutral of the transformer bank at this station it is hoped to locate faults at a reduction in sectionalizing operations.



Editorials

S. B. WILLIAMS, *Editor*

Integration Versus Absorption

IN SIGNING the contract with the Aluminum Company of America, whereby TVA secured the Fontana Dam site as well as the operation of the company's chain of hydro plants in the Little Tennessee River, Vice-Chairman Lilienthal called the contract "one of the most important developments in the relations between government and business in our time."

In further explanation Mr. Lilienthal pointed out that management of a private utility system by a public agency, based upon contract between the two parties reached by negotiation, is a pioneering step in a new kind of relationship between public and private enterprise and the first such arrangement to be entered into in this country.

The arrangement referred to is the integration of the Aluminum Company's hydro projects with that of TVA under the latter's direction for the most effective use of the water in the Little Tennessee. The only property acquired by TVA is the undeveloped site at Fontana.

Integration without absorption is something new in the relationship of private industry with government respecting power property ownership. It may have some real possibilities if some basic principles are established that are fair to both sides.

It is not necessary for a government project to acquire the distribution system of a private company in order to operate. The two types of systems can be integrated in a manner that will preserve ownership and secure the maximum effectiveness of the joint investment. Hydro systems with large ratios of dump to firm power would find their greatest effectiveness in such an integration.

The question of choice of management of production would have to be determined through negotiation, again based upon certain principles, the first of which would undoubtedly be the mutual recognition of the principal right. In the present Tennessee case, for instance, the principal right lay with TVA, which is the primary factor operating the water of the Tennessee Valley.

Strangely enough, it is this kind of sensible integration that the government is fighting tooth and nail in San Francisco, where a private utility is managing for the city the distribution of publicly generated energy.

Moreover, it is this kind of integration that would make unnecessary the expenditure of funds for steam generation in California to firm up federal power. And in the Northwest integration through negotiation would greatly improve the whole power situation of that area.

While this Tennessee agreement isn't a clean-cut case of private and public utility integration, it is enough of an indication that the two can work together and that corporate suicide isn't necessary.

"Electric" and "Electrical"

NOTHING DETERRED by what happened when, some weeks back, we chatted about words and how engineers mistreat them, we venture again to return to the subject, just like a dog digging up a favorite bone to gnaw on it for a while. But this time no one will be able to jump in with a glad cry and prove, as so many did on that previous occasion, that we don't know what we are talking about.

The subject for discussion today is a pair of words, "electric" and "electrical"—which one should be used when and how.

A reader writes in entreating us to tell him how to choose between these words because he has been ordered to instruct the stenographers of a large company on this point of adjectival discrimination. We can't refer him to the dictionaries nor to the literary laws of the American Institute of Electrical Engineers as set forth in the classic, "Information for Authors," because he has already visited these founts and has come away still athirst. In desperation he appeals to us, saying that if ELECTRICAL WORLD has developed a standardized differentiation between "electric" and "electrical" he will be most happy to know what it is. Well, ELECTRICAL WORLD has not done anything of the kind and, moreover, will not, at least not until brasher spirits push the present occupants out of the editorial sanctums.

Probably the trouble stems from the fact that the word "electric" started in life as a noun, meaning a material, as amber or glass, on which electricity accumulated. From this noun the adjective "electrical" was formed by adding "al" to describe a material capable of being used as an electric, and from that meaning enlarging to include associated with, pertaining to, having the appearance of, etc. Also, the noun form could and was used as an adjective of designation to identify that which accumulated on the electric and, when it was touched, flowed from it—the "electric fluid," the fluid from or of the electric. Then "electric fluid," an awkward term, was called "electricity," a word wholly unamenable to the descriptive adjectival terminations of "al" and "y." The

noun itself was usable as a designative adjective, still is largely so used in England, for instance, the terms "electricity supply system," "electricity undertaking," "electricity meter." But in this country the word "electricity" never got very far as a designative adjective and it was wholly incapable of change into a descriptive one.

Well, every self-respecting noun simply has to have associated adjectives, and what was "electricity" to do? It simply grabbed the adjectives belonging to "electric" and made them its own. And, like adopted children, these adjectives have no ties of grammatical consanguinity with the foster parent.

There's where the trouble lies. What is to be done about it? Nothing at all, so far as we are concerned. We are content to use, and to allow all others to use, "electric" and "electrical" wherever the one or the other is more comfortable to the ear of the user, until in time any difference of meaning between them is erased. We take no side, assert no dogma, pronounce no judgment. And that is why we said at the beginning of this essay that no reader can slap our ears back with gleeful proof of error.

Field Inspection More Important Than Ever

IN TIMES of hastened construction of facilities to meet urgent defense loads field inspection of the jobs as they progress is of more than normal importance because in this speed-up in factory and field there is not the time for the usual careful workmanship. Large companies can justify staffs which are given such assignments exclusively. By working on an independent basis they can relieve the groups which designed the installations of much of the field check-up on the little troubles with material and equipment and, more particularly, see to it that workmanship is such as to give sustained trouble-free performance.

Smaller companies which cannot justify an entirely separate field organization for this function might very profitably establish the task as the positive assignment of competent engineers, partly in the design group and partly in the operating group. In this way there can be specific delegation of the duty of seeing that things are installed as intended, or even occasionally of getting better results than were originally conceived. They will have authority to see that contracts with manufacturers and contractors are truly carried out. They will see that the right size buses and conductors are used, that all joints make good contact, that there are no unguarded live parts, no unprotected moving parts, no closed circuits left open, no relays and interlocks that do not function as intended.

Beyond this there is the preliminary test of the assembled equipment to see that breaker trips are set right, voltage regulators and tap changers properly adjusted, oil provided to the right levels and, in short, everything in apple-pie order to work directly at the start and for a good long time thereafter. In fact, the same setup can be charged with the responsibility of such periodic checks as fall beyond the scope of routine testers.

The point at the moment is not to skimp on inspection, field supervision and check testing just because the urge is to get things done and operating. The penalty may be a little epidemic of annoying troubles that will hamper the much-wanted results.

Poliomyelitis and Electricity

FROM the Los Angeles County Chapter of the National Foundation for Infantile Paralysis comes the startling intimation that epidemics of anterior poliomyelitis seem to have some degree of correlation with the extent to which the victims are encircled by power wires. The power system pattern of the city has been studied in the light of the cases over an eighteen-year period and the inference drawn that it is not risky to live in a small triangle bounded by heavy power or in a large triangle bordered by "weak currents," but hard to live at certain critical intermediate points. Strange to electrical engineers is the suggestion that the "line of infection lay along a path where the forces exerted upon each other by the conditioning currents were in *balance*." They would interpret balance as a zero resultant locus and therefore devoid of potentiality for harm.

Electricity is a weird and wonderful manifestation. It can kill, if safety codes are ignored. It can cure, if the electrotherapists can be believed—at least, high-frequency diathermy is credited with beneficial accomplishments. Now the fear is advanced that the very weak electrostatic and magnetic fields created wherever power flows in wires can have adverse effect upon the normal healthy electrical functions that take place in the nerve structure of the body when executing muscular movements or metabolizing the assimilated foods.

If it is the weakest fields that cause the predisposition to this lamentable disease, why should not the radio and the telephone close by be as suspect as power circuits at a distance?

Doubtless no one will suggest an atavistic move that would take us back to pre-Edison days of no electric power. Nor are we likely to discard the radio and the telephone and the trolley bus. Electricity is with us to stay. Consequently the medical explorers would do well to look for several other possible culprits. It might even facilitate their arrival at the much-sought-for answer to dread infantile paralysis if they would collaborate with a good electrophysicist. He could tell them very quickly what the electrical field strengths are in their infection areas, correct their electrical terminology and then leave to the physiologists the question whether these fields could possibly disturb the typical electrical process in these susceptible bodies of ours.

Washington Comment

By GEORGE E. DOYING, Jr., Washington Staff

New Defense Capacity Financing Dilemma

THE Securities and Exchange Commission is going to have the final say-so on the financing of electric utility armament expansion. The agency, armed with its statutory powers under the Holding Company Act, is being accepted into the OPM-FPC partnership as its "financial department," so to speak.

This, inevitably, means some tailoring of generator and transmission line installations for munitions to fit the limitations and standards of the Holding Company Act. Not a curtailment of the over-all picture, but rather it means some compromise with other considerations as to locations and amounts of construction by individual companies.

Each Case Separate

Such an arrangement is possible and practical, it is contended, because the generating expansion for war needs, for the most part, is by areas rather than by specific companies. Thus, there is "room" in which to get the same thing done by selecting one of two, or several, companies.

SEC is in the picture "on the ground floor"—in the planning stage. First ideas of OPM's Power Unit of where to place new capacity for armament plans are being sent to SEC's Utilities Division for reports on the financial ability of the companies involved to swing the deals. Final decision will be shaped, in part, upon the conclusions from the "financial department."

What will be SEC's attitude toward defense financing? That agency concedes above all other factors that the job must be done, that the defense program comes first. But officials temper that blanket statement with the modification that in so far as possible it must be done in a way which will strengthen, now and later, the stability of the operating companies. That means a case by case approach which, they maintain at SEC, can be made without loss of time, through this system of advance appraisal. Beyond this, SEC is willing to agree that some concessions will have to be made over what would be done in normal times. These won't be many, however, and not until all other possibilities have burnt out.

It is likely that the first approach of SEC to financing problems will be to determine whether expansion cannot be paid for out of pocket. Studies indicate to the division staff that a "good share" of construction work will not require new capital, that it can be met by realistic conservation of cash, by providing adequate depreciation reserves, and, in some cases, by shaving dividend payments. This is how the industry financed the bulk of its construction during most of the depression years, says the SEC, and there is no reason why this source of funds cannot be counted upon now to carry a considerable, although admittedly smaller, proportion of the load.

No Compromise

SEC does not, however, have any idea of damming up the flow of dividends to divert money into construction budgets. Where dividend payments are considered "unrealistic," persuasion—or order—will be invoked, but the ruling policy as outlined by officials is that conservation of cash for construction will be considered in the light of justice and fairness to all investors, and to all companies involved. The issues of depreciation reserve and other such non-cash accounts will be met in the same way.

In cases where new money is involved SEC's past attitude on bonded debt can be expected to prevail, with limited modifications. Nowhere in the agency is there evidence of any intent to permit utilities to "run to the banks." And in this respect, bonds sold to the Reconstruction Finance Corporation will be scrutinized for their effect upon capital structure just as would bonds offered to private buyers. The amended plans of Mississippi Power Company and Gulf Power Company, which originally applied for permission to sell new bonds to RFC and then revised the plan to include sharp rearrangement of their financial setup, can be considered cases in point. Neither application was denied formally, but SEC told the companies they would be, and then worked out with them a revised plan which is expected to fill the bill.

Government Money

SEC takes the position that it must look beyond the war on this bond question, and to what will happen to utilities loaded up with debt service charges when the armament program stops. Net result is to make SEC appear to be more conservative and cautious than many OPM planners who say that plant capacity must be had regardless of consequences, that post-war problems will have to wait for solution until Hitler is licked. From another angle, of course, SEC's position is merely "reform as usual."

How much government financing of added facilities there will be is a disputed point right now. SEC wants to see the government put up the money for facilities for which there is no immediate show of normal need in the utility system. It feels that definite provisions should be worked out at the time such facilities are installed for installment purchase by the utilities of the government's title, the period of time to coincide with the probable period required for such equipment to be needed as part of the utility's plant account. This, of course, is the Defense Plant Corporation type of contract being used for considerable plant expansion by private industry for taking on added war production.

There may be a flaw in this arrangement, however. Defense Plant

[*Continued on page 124*]

NEWS OF THE WEEK

Abnormal Load Demands Being Met in San Diego

President Raber says that company is anticipating growth and there is no thought of curtailing the aggressive new business policy — Silvergate station to be ready in 1942

Abnormal demand for both gas and electric service are causing periodic revisions of the expansion program of San Diego Gas & Electric Co. President William F. Raber said that little difficulty is anticipated in meeting these demands and there is no thought of curtailing the company's aggressive pursuit of new business.

In addition to the 1941 construction program, plans are now under way for the building of several new substations, the largest to be located adjacent to the new Silvergate power station and will be known as Sampson substation. Mr Raber said that it will serve the Southbay defense projects, the Rohr Aircraft plant and will care for the general growth of that district. The capacities of the National City and Point Loma substations will be doubled.

Adequate Power Supply

Mr. Raber said that San Diego is expected to contribute much to the national defense program and is gearing itself accordingly. His company, he said, had adequate power capacity to meet the abnormal demands. New power sources are now being developed in anticipation of even greater needs.

At the present time the facilities of the company are capable of producing 125,000 kw., which will be increased to 139,000 kw. by October 1. The peak for the busy month of June reached 82,150 kw., as compared with the peak of 62,600 kw. in June, 1940. Mr. Raber said that even at that rate of increase it would take some time to reach capacity. The company engineers figure that a peak load of about 115,000 kw. will be reached in December. By September, 1942, the new Silvergate generating station will be completed, supplying another 35,000 kw. of capacity.

Work is well under way on the Silvergate generating station which will house the new General Electric turbo-generator and two Babcock & Wilcox 266,000-lb.-per-hour boilers. The new unit will be hydrogen-cooled and operate at 850 lb. and 900 deg.

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Pit Not Navigable, Engineer States

The Pit River in California, where Pacific Gas & Electric Co. proposes to build a hydro-electric project, is not navigable, Brig.-Gen. George P. Pillsbury, retired, formerly assistant chief of Army Engineers, testified last week at a Federal Power Commission hearing.

The commission called the hearing to determine if the utility's contention that the project would not require a federal license was correct.

The former army engineer stated

NEW STEAM STATION—By the fall of 1942 this excavation will be covered by the new Silvergate power station of San Diego Gas & Electric Co., which will house a new 35,000-kw. General Electric unit and two Babcock & Wilcox boilers

DAM SYSTEM—This is how the TVA pictures its vast government hydro-electric development with its series of dams and power houses to supply energy to the area dotted with defense industries

its excessive slope and boulders which lie in its bed. He said he inspected the river last week. Basing his statement on reports made to Army engineers, General Pillsbury said it would be "utterly impossible" to use the Pit River for navigation and declared that operation of the proposed hydro-electric project would not affect navigability of the Sacramento River, into which the Pit empties. The Pit River, he added, could be made navigable only by a series of locks and dams, and because of the slope the river would be literally a stairway of these structures.

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Utility to Start Work on New 69,000-Volt Line

Construction of a 69,000-volt transmission line from Stallings to Centralia, Ill., will be begun soon by the Illinois-Iowa Power Co., according to an announcement made recently in Centralia.

Another 69,000-volt line from Ashley to Centralia was recently completed, but has not yet been energized because of delays in the shipment of substation equipment. The equipment, scheduled for shipment last July, has been held up at the factory by defense orders, it was said. These two lines will more than triple electric power facilities in Centralia, which is now served by two 33,000-volt lines, it was declared.

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Chicago Utility Granted Extension of Time

Federal Power Commission has announced that the time allowed Chicago District Generating Corp. to revise its rates and charges and file the revised schedule with the commission has been extended from August 15 to September 16. Except for the extension of time for the filing of revised rates and charges, the July 16 order is to continue in full force and effect, the commission said.

The commission's action followed the filing of a motion by the corporation that the commission's order of July 16 be stayed and suspended pending the filing and disposition of a petition for rehearing and reargument.

In its order granting an extension of time, the commission said that "the extension herein granted shall not be deemed an acquiescence in or a recognition of the validity of the various reasons for rehearing or stay recited in respondent's motion."

NEWS BRIEFS

ONE INTERESTING EFFECT of the war was seen in the 1940 report of the Sydney, Australia, municipal system, which showed that authorization was given for coal reserves to be increased in 1941 from a ten weeks supply to sufficient for the maximum six-month consumption.

FEW PEOPLE reach the age of 90 and fewer still keep at work at that age. But on July 27 M. H. Paine, inventor of the Paine wing toggle bolt, so widely used in the electrical industry, and chairman of the board and plant superintendent of the Paine company, was down to work as usual, celebrating not only his fourscore years and ten but 74 years of productive service as well.

WOMEN ENGAGED in home service and lecture-demonstration work in electric utility companies will gather for a "Parade of Demonstration Ideas" in New York September 4-5 staged by the home service committee of the Edison Electric Institute. New, streamlined techniques will occupy the two-day program.

TWO YOUNGSTERS are proud recipients of four-year scholarships to Union College in Schenectady. Charles P. Steinmetz Memorial scholarships have been awarded to Edward L. Bates, Jr., a General Electric employee, and Albert J. Taggi, the son of an affiliated company employee.

THROUGH THE SUBSCRIPTIONS of 775 employees of the central division of the Puget Sound Power & Light Company of Seattle a lasting memorial to the memory of Leslie R. Coffin, who was vice-president and manager of the district at the time of his death, has been achieved in the donation to the Seattle Children's Orthopedic Hospital of a unit that completely shockproofs the early-style mobile X-ray unit used for bedside examinations and therapy. In addition, the company furnished a new shock-proof X-ray tube and housing complete with all cables and accessories.

BOSTON EDISON'S POWER SALES STAFF will shortly make a comprehensive survey of all classes of industrial heating applications to obtain data useful in defense work, load building and improving customer service. Individual installations will be studied in relation to existing equipment capacity, utilization of new methods and expansion of plant activities.

Interconnection Study Insures Stable Service

Utah Power & Light uses calculating board to determine factors in transmission interconnected system — Company is spending $1,455,000 on new construction — New rural lines planned

In the interest of greater service reliability there has been in progress an a.c. calculating board study of the interconnections of Utah Power & Light Co. with the systems of Idaho Power Co. and Montana Power Co. for the purpose of determining power flow and stability characteristics.

G. M. Gadsby, president and general manager, stated that also a d.c. calculating board study of the transmission system has been made to determine fault current magnitudes and service as a basis of relay improvement programs. He declared that transmission line fault elimination is continually being improved by study of oscillograph records obtained in actual operations.

Centralized System

Through the use of a centralized load-dispatching system, Mr. Gadsby said, the loading of production equipment, transmission lines and substations is constantly under observation and direction in the interest of efficiency and immunity of important units from interruptions.

This year the company is spending approximately $1,455,000 on new construction, as against $1,554,000 last year. Cost of distribution plant additions and betterments in 1940 was $1,015,000 and it is estimated that the corresponding expenditures during 1941 will be $910,000. Cost for additions to high-voltage lines and transmission substations was $240,000 in 1940 and is expected to reach $360,000 this year.

The major construction project undertaken in 1940 was the interconnection of the transmission systems of Montana Power, Idaho Power and Utah Power & Light companies. The work was divided among the companies. Of the 274 miles of 250,000-cir.mil, 161-kv. transmission line, 57 miles was allocated to Utah Power & Light. The construction of a 45,000-kva transformer and switching station was necessary at the interconnection point and was also undertaken last year for completion in 1941. Utah Power & Light also increased its substation plant by the construction of a new 5,000-kva., 44-kv. to 11-kv. substation at Salt Lake City.

The construction program this year also includes principally rural electrification projects, extensions and betterments of urban distribution systems and additions to distribution substation capacity and equipment.

Last year the company constructed 283 miles of rural lines and expects to build 150 miles this year. A total of 1,871 rural customers were added in 1940 and 950 are expected to be added this year.

Total volume of appliance sales, company and dealers, was $6,712,000 in 1940 and it is expected to reach $6,622,000 this year. E.A.R. in 1940 was $341,000 and is expected to be $347,000 this year.

Mr. Gadsby said that protective fencing wherever practicable has been provided or rehabilitated. Floodlighting has been amply increased and watchmen or guards are on duty wherever the nature of the equipment is such as to require it.

Precautions have been taken to safeguard plants and equipment and the company's power reserve capacity, including the supply available from its interconnections, has been thoroughly studied and compared with the load forecasts.

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Ask to Sell Lines to Power District

Nebraska Public Service Co., Sioux City, Iowa, has filed an application with the Federal Power Commission seeking authority to sell all of its electric transmission and distribution lines and electric substations to Consumers Public Power District of Nebraska for $318,000. The company's application waives hearing on the proposal.

The company is engaged principally in the purchase and resale at retail of gas and electricity in northeastern Nebraska and serves the following Nebraska communities and other utilities: Allen, Concord, Dixon, Hubbard, Jackson, Martinsburg, Maskell, Newcastle, Obert, Ponca, Waterbury, Dakota City, Central States Electric Co. of Nebraska, Consumers Public Power District and South Sioux City.

Nebraska Public Service Co. purchases substantially all of its requirements of electric energy from Sioux City Gas & Electric Co.

A clause in the agreement between buyer and seller provides that the obligations of the district to acquire the properties and to pay therefor is subject to the conditions that on or before the closing date the "United States shall not have become engaged in war."

NEW TRANSMISSION LINE—Joseph N. Sargent, operator (left); L. B. Fuller, chief engineer Utah Power & Light, and Henry L. Senger, chief engineer Idaho Power Co., participate in the synchronization of the new 275-mile, 161,000-volt transmission line from Anaconda, Mont., into the Utah and Idaho 132,000-volt systems

Northwest Utility Pushes System Improvement Plans

Puget Sound Power & Light is adding capacity to meet defense loads and normal customer increases — Spending about $3,500,000 on system improvements — Takes defense measures

Situated in the heart of the Pacific Northwest, where the government is pushing a program of public ownership, Puget Sound Power & Light Co. is moving ahead with its job of supplying its customers and the increased defense requirements.

This year the company is spending approximately $3,500,000 to improve system facilities, with about $1,500,000 going for the distribution system. About $1,000,000 is being spent on hydro plants and other items are being taken care of as needs require.

Defense Measures

President Frank McLaughlin says that "we are providing adequate lighting near the areas in which are located generating stations, operating and outdoor transformer and switching stations, and other vulnerable installations," in discussing defense measures. He declared that in most cases plant property has been inclosed by fencing and guards have been provided wherever such protection was considered to be necessary. Arrangements have also been made with law enforcement agents wherever their services could be made available.

As for plans this year, the company will add 12,500 kw. of generating capacity by rehabilitating two generators and 7 miles of flume at the Electron generating station. These generators had been cut out of service in November, 1936, when they were damaged by a landslide.

The 1941 program also includes major substation additions to Renton switching station, to include a 30,000-kva. transformer bank linking together the 110-kv. and 55-kv. systems at that point, and including 110-kv. line extensions and switching facilities for solidifying the transmission network between Beverly Park substation and White River generating station. Mr. McLaughlin said that this development will greatly improve the flexibility of power delivery and increase the reliability of service to major load centers.

The company has plans for the installation of 45,000 kva. of condenser capacity at salient points on the system as conditions warrant. At Rock Island hydro station additional flashboards are to be installed to raise the dam crest, which will add considerably to the annual output of the plant.

New Rural Lines

Last year the company built about 150 miles of rural lines and estimates that 150 miles will be added this year. There were about 4,800 rural customers added during 1940 and about 5,000 will be put on the lines this year.

Total volume of appliances sold in the territory during 1940 was $5,875,487 and added about $649,844 of E.A.R. This was based on the three major appliances—ranges, water heaters and refrigerators. For 1941 the company has set a quota of $698,200 in E.A.R. from the sale of major appliances by the company and dealers.

An extensive program of oil circuit breaker replacements initiated in 1938 to cover a three-year period has reached the final stages this year. This program was the result of studies and investigations made to determine the maximum duty in percent of rating of system circuit breakers of all voltages, so that adequate measures could be taken to avoid risk of unsafe operations due to the increased burdens placed on existing equipment by increases in system generating capacity and in transmission interconnections.

System studies are being kept abreast of power loads and prospective load growth is being estimated. The company has set a reserve capacity of not less than 40,000 kva.

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Board Adjourns Hearing on New Kentucky Plant

"The Tyrone plant would rank at the top in efficiency of all similar plants erected in the United States in recent years," E. W. Brown, vice-president and chief engineer of the Kentucky Utilities Co., testified at a recent hearing before the state Public Service Commission.

The utility is seeking approval of its plan to spend $3,975,483 on a steam-generated plant on the Woodford County side of the Kentucky River (ELECTRICAL WORLD, August 2, page 4).

Mr. Brown's testimony was largely an elaboration of proposals set forth when the hearing was started in late July. At that time the utility maintained that national defense requirements made the plant necessary.

The commission adjourned the hearing indefinitely pending preparation of further evidence by the company, particularly on the financial aspects of the proposed new plant.

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Will Push Appliance Servicing-Repair

Consolidated Edison System has announced plans for a program for the servicing and repairing of all gas and electrical appliances used on the company's lines. The plan is designed to decrease the demand for new appliances so as to release materials for national defense.

According to E. F. Jeffe, vice-president Consolidated Edison, the plan calls for the setting up of certified service and repair stations under standard supervised operation, prices and terms. It also will include financing to provide the timely repair of any appliance from an electric iron to a large refrigerator. Dealers now cooperating in the sales campaign sponsored by the company will be invited to take part in the new activity as a means of replacing the income which is expected to be lost to them because of the lack of new appliances resulting from defense needs.

The plan is expected to appeal to small distributors and manufacturers for the same reason.

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Orders Air-Blast Breakers

Blackstone Valley Gas & Electric Co., a Stone & Webster property at Pawtucket, R. I., has ordered nine Allis-Chalmers metal-clad, vertical-lift, air-blast circuit breakers in connection with the modernization of its No. 1 station at Pawtucket. These are all 2,300-volt units and range in rupturing capacity from 100,000 to 150,000 kva. One will serve a generator, two are for auxiliary ties to a 13-kv. bus installation, one for emergency tie service outside and five for the 2,300-volt station auxiliary circuits. Delivery is anticipated about the end of the year and the installation is one of the first of its type.

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Awards Plant Contract

Superior Water, Light & Power Co., Superior, Wis., has awarded a general contract for construction of its new steam-electric power plant.

New Columbia Power Program Suggested

A new idea for a Columbia Valley Power Authority designed to eliminate political disputes from this legislation has emanated from Eugene, Ore. James A. Rodman and Edward G. Boehnke, calling themselves "laymen" as far as power is concerned, sent a draft of their plan early in August to Senator McNary after checking it with J. W. McArthur, manager of Eugene's city light department.

The plan suggested a *status quo* of operations of present generating and distributing systems of both public and private systems in the Pacific Northwest, and an interconnection of these systems to attain the maximum potentialities of power output. The authority would operate under the direction of a commission of three, one representing the Federal government, one the publicly owned utilities, and one the privately owned utilities.

The plan referred to recent studies by utility engineers in the Northwest indicating that certain interconnections between the Bonneville-Grand Coulee system and the already interconnected private systems could add 100,000 kw. to the available firm power in the region, with an expense for interconnections of less than $1,000,000. The authors of the plan contrasted this with the proposal in the Hill bill for a Columbia Power Authority, calling for the use of government credit to the extent of $200,000,000 to buy out existing private systems. The authors pointed out that every known method of raising capital was being employed to carry on the national defense program and that better uses could be found for this $200,000,000 of national credit.

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Repair Priorities Program Withdrawn

Even before it could be put into effect, the repair and maintenance priorities program (ELECTRICAL WORLD, August 16, page 8) has been withdrawn for a drastic overhaul of procedure. The new administrative machinery is to be announced as promptly as possible, to minimize confusion, but in the meantime copies of Form PD-67, upon which eligible companies, including utilities, were to make application for use of the rating, have been withdrawn.

Revision being worked out involves only the procedure for using the blanket A-10 rating assigned to all repair and maintenance orders for essential public services; the rating itself will remain the same. The new procedure, it is planned, will be considerably simplified, particularly to eliminate much of the paper work involved in the original set-up.

Delay in getting the repair and maintenance priority program into operation is holding up completion of plans being worked out by OPM's power unit for blanket project priority rating P-A-E—most utility generating and transmission line construction. J. A. Krug, OPM power co-ordinator, has won from the priorities division agreement that utility projects should have a project priority set-up, but details are not completely worked out yet. Meanwhile, individual project problems can be taken up with Mr. Krug or his priorities chief, John C. Parker.

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Carpenter Opposes Texas Power Pool

Declaring that the "proposed plan of certain governmental agencies to establish a power pool in Texas at an estimated cost of $40,000,000 is astonishing and absurd," John W. Carpenter, president of the Texas Power & Light Co., Dallas, pointed out that as far as his company and other private power companies in this state are concerned there is no shortage of power and no shortage is in prospect for future needs.

"I call attention to the fact," Mr. Carpenter said, "that the Texas Power & Light Company not only has ample power for all of its customers and future growth of business, including national defense industries and Army camp requirements, but it has for some time been sending power to the East to help the TVA situation in its shortage.

"The much-talked-of government-promoted hydro plant at the Morris Sheppard Dam on the Brazos River has been standing idle for several months and if there is any power shortage those who are responsible for its standing idle certainly have not been contributing to the necessities for power which they are now claiming are such as to warrant the large expenditure of some $40,000,000 for additional power . . ."

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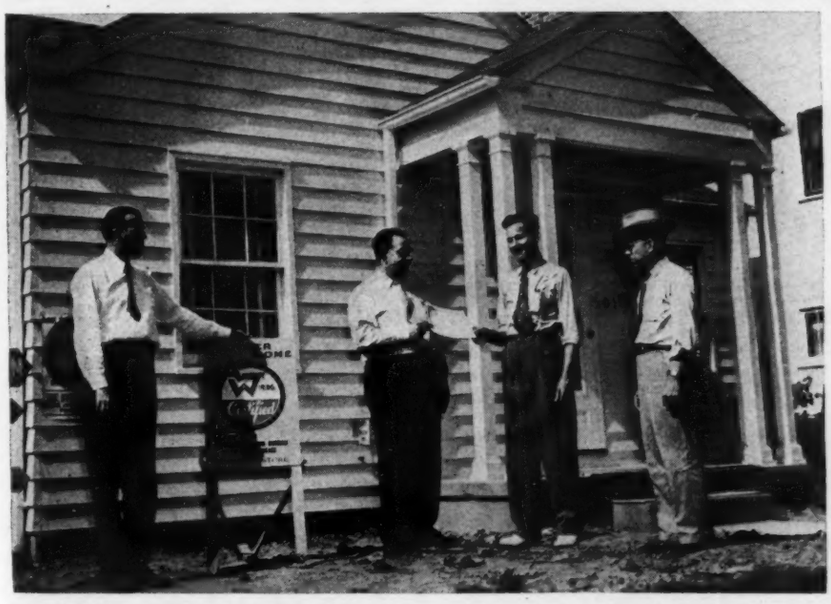
Flint River Project Hearing Set by FPC

Federal Power Commission has announced that a public hearing will be held on September 15 in Washington, D. C., in the determination of the actual legitimate original cost as of December 31, 1932, of the Flint River project, No. 1218, of the Georgia Power Co., as well as the accounting, including the disposition on the books of account of such amounts as may be disallowed as not part of such actual legitimate original cost, to be prescribed for the project. The company has asked consideration of the sum of $2,072,042 as the actual legitimate cost of the project.



ADEQUATE WIRING—South Bend's industry points with pride to its first certified adequately wired home. More than 3,000 visitors inspected the home during a three-day display period. L. to r., John Webb, Indiana & Michigan Electric Co., and secretary of the South Bend A. W. Bureau; Charles Colip, of Colip Bros., Inc., electrical contractors, and president of the bureau; William Haase, happy owner, and L. R. Palmer, Builder's Store, electrical contractors who did the wiring

Fall River Electric Holds Safety Record

The Fall River Electric Co., Fall River, Mass., holds the best all-time no-injury record, 4,337,640 man-hours, according to 1940 report of the National Safety Council, Inc.

It was reported that public utilities have better records in frequency than in severity, when compared with rates in other industries. Frequency rates average 3 percent below the all-industry rate of 12.52. Public utilities ranked fifteenth in severity.

The outstanding unsafe acts in serious injuries were: (1) Failing to use protective equipment such as rubber gloves, (2) unnecessary exposure to danger, such as entering areas unsafe due to electrical and gas hazards, and (3) unsafe use of tools and equipment, such as using defective tools. The principal personal cause was improper attitude, such as disobedience of instructions.

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Urge "No Blackouts" Now in Light Safety Drive

Challenged by urgent national defense needs for safe 24-hour-a-day transportation of troops, workers and supplies on the streets and highways of the nation, the United States Junior Chamber of Commerce expects to go "all out" in its "Safety with Light" campaign this year.

The "Safety with Light" fiscal year that has just ended finds 156 Junior Chambers of Commerce throughout the country enlisted in this new and growing movement.

Now the legislation for defense highway needs has spurred the USJCC to new enthusiasm for its "Safety with Light" task in 1941–42. The mounting traffic toll is galvanizing at least four hundred separate organizations into an attempt to light those stretches of the strategic network and new access roads that are essential to the defense effort. "No Blackouts for Defense" is the slogan for the drive toward a new safety high for night traffic accidents in the forthcoming year.

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Utility Rates Exempted in Price Control Bill

Utility rates are specifically exempted from provisions of the price control bill as it is now before Congress. The official explanation of Price Administrator Henderson of this is that "complicated valuation proceedings such as are customarily required in traditional public utility rate controversies obviously have no place in the administration of emergency legislation of this character."

Exemption of utility rates, however, does not permit sellers of ordinary commodities to escape authority of the bill by claiming public utility status, nor does it exempt the sale by any public utility of ordinary commercial products or services.

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Utilities of Virginias to Hold First Meeting

The first annual convention of the Public Utilities Association of the Virginias will be held at The Greenbrier, White Sulphur Springs, W. Va., on October 3 and 4.

At the joint meeting last year of the utilities of Virginia and West Virginia, in conjunction with the annual convention of the Public Utilities Association of West Virginia, a resolution was adopted whereby the Virginia utilities might become members of the association. Since that time the proposition has been formally acted upon.

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Speed Work on Plant of Hawaiian Utility Concern

Defense power demands in Hawaii are causing work to be rushed on a new 3,500-kw. steam plant of the Hilo Electric Light Co., Ltd., at Hilo on the largest of the Hawaiian Islands. Station equipment will include a 13.8-kv., three-phase, 60-cycle General Electric turbo-generator operating straight condensing with a Westinghouse condenser and Worthington high-pressure and low-pressure heaters.

The integral B&W boiler is rated at 56,000 lb. per hour with steam pressure at 450 lb. and temperature of 750 deg. F. The boiler will be under full automatic Bailey control. Oil fuel will be used.

COMING MEETINGS

International Association of Electrical Inspectors—Southwestern section, Hotel DeAnza, San Jose Calif., August 25-27. H. L. Gerber, secretary. Room 205, City Hall, San Francisco, Calif., northwestern section, Winthrop Hotel, Tacoma, Wash., Steptember 2-5. F. D. Weber, secretary, P. O. Box 70, Portland, Ore., western section, Hotel St. Paul, St. Paul, Minn., September 8-10. F. H. Moore, secretary, 320 N. Meridian St., Indianapolis, Ind.; eastern section, Mayflower Hotel, Washington, D. C., September 22-24. F. N. M. Squires, secretary, 85 John St., New York, N. Y.; southern section, McAllister Hotel, Miami, Fla., September 29-October 1. Joseph Whitner, secretary, P. O. Box 1743, Atlanta, Ga.

National Association of Railroad and Utilities Commissioners—Fall meeeting, St. Paul Hotel, St. Paul, Minn., August 26-29. Clyde S. Bailey, secretary, New Post Office Bldg., Washington, D. C.

American Institute of Electrical Engineers — Pacific Coast convention, Yellowstone National Park, August 27-29; South West district, Coronado Hotel, St. Louis, Mo., October 8-10. H. H. Henline, national secretary, 29 West 39th St., New York, N. Y.

Pennsylvania Electric Association—Annual convention, Bedford Springs Hotel, Bedford Springs, Pa., September 3-5. A. B. Millar, managing director, State Street Bldg., Harrisburg, Pa.

New York State Association of Muuicipal Electric Utilities—Annual conference, Jamestown, N. Y., September 3-5. Thomas J. McKee, secretary, Jamestown Board of Public Utitlities, Jamestown, N. Y.

Maryland Utilities Association—Mid-year convention, Ocean City, Md. September 5-6. W. Cook, secretary, Potomac Edison Co., Bldg., Frederick, Md.

American Chemical Society—Symposium on Electrical Insulation, sponsored by the committee on chemistry. National Research Council, Atlantic City, N. J., September 11, R. N. Evans, Consolidated Edison Co., 55 Johnson St., Brooklyn, N. Y.

Rocky Mountain Electrical League—Annual convention, Stanley Hotel, Estes Park, Colorado, September 11-13. George E. Lewis, manager Gas and Electric Bldg., Denver, Colo.

Wisconsin Utilities Association—Accounting section, electric, gas and transportation. Lawsonia Hotel, Green Lake, Wis., September 12-13; electric section, Hotel Schroeder, Milwaukee, October 13-14. A. F. Herwig, executive secretary, Room 502, Brumder Bldg., 135 West Wells St., Milwaukee, Wis.

Illuminating Engineering Society — Annual convention, Atlanta-Biltmore Hotel, Atlanta, Ga. September 22-25. Frank G. Horton, executive secretary, 51 Madison Av., New York, N. Y.

Association of Iron and Steel Engineers—Annual convention, Cleveland Public Auditorium, Cleveland, Ohio, September 23-26. Brent Wiley, managing director, Empire Bldg., Pittsburgh, Pa.

Indiana Electric Association—Annual fall meeting. French Lick Springs Hotel, French Lick, Ind., September 24-26. R. E. Bloosom, secretary, 1414 Circle Tower, Indianapolis, Ind.

Southeastern Electric Exchange—Engineering and operation section, Suwanee Hotel, St. Petersburg, Fla., September 25-26. J. W. Talley, executive secretary, 303 Haas-Howell Building, Atlanta, Ga.

Electrochemical Society — Fall meeting, Chicago, Ill., October 1-4. Colin G. Fink, secretary, Columbia University, New York, N. Y.

Edison Electric Institute—Meter and service committee, New Ocean House, Swampscott, Mass., October 2; prime movers committee, St. Louis, Mo., October 6-7; electrical equipment committee, Hotel Cleveland, Cleveland, Ohio, October 13-14; transmission and distribution committee, Netherland-Plaza Hotel, Cincinnati, Ohio, October 20-22. Col. H. S. Bennion, managing director, 420 Lexington Av., New York, N. Y.

Public Utilities Association of the Virginias—First annual convention, The Greenbrier, White Sulphur Springs, W. Va., October 3-4. A Bliss McCrum, secretary, 612 Charleston National Bank Bldg., Charleston, W. Va.

National Electrical Contractors Association—Fall meeting, Rice Hotel, Houston, Tex., October 6-8. L. W. Davis, general manager, 420 Lexington Avenue, New York, N. Y.

American Society of Mechanical Engineers — Fall meeting, Louisville, Ky., October 13-15. C. E. Davies, national secretary, 29 West 39th St., New York, N. Y.

National Electrical Wholesalers Association — Semi-annual convention, Hotel Statler, Detroit, Mich., October 14-17. E. Donald Tolles, managing director, 165 Broadway, New York, N. Y.

American Welding Society—Annual meeting in conjunction with National Metal Exposition, Bellevue Stratford Hotel, Philadelphia, Pa., October 19-24. Miss M. Kelly, secretary, 29 West 39th St., New York, N. Y.

National Electrical Manufacturers Association — Annual meeting, Waldorf-Astoria Hotel, New York, N. Y., October 27-31. W. J. Donald, managing director, 155 East 44th St., New York, N. Y.

Energy Production Shows Slight Gain

Practically a horizontal gain in energy production was made in the week ended August 16, as output of electricity rose to 3,200,818,000 kw.-hr., an advance of 0.15 percent over the preceding week and of 16.6 percent over the similar week of 1940, according to the Edison Electric Institute. The increase over the like week of two years ago amounted to 30.4 percent.

New England, Southern States and Pacific Coast regions shared in the gain over the corresponding week of last year. However, the rise in the Southern States area must be discounted somewhat in the light of the fact that just a year ago that section showed a decrease in output due to a hurricane.

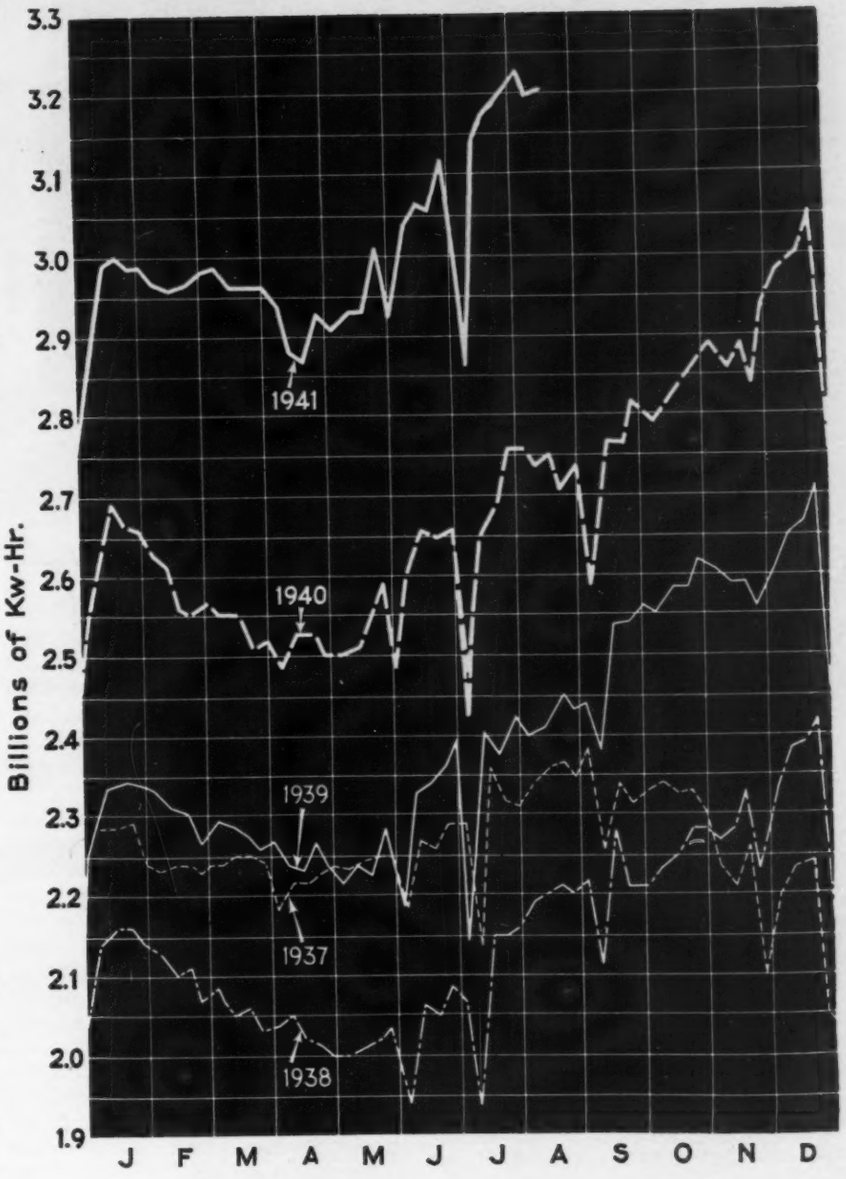
Weekly Output, Millions Kw.-Hr.

1941		1940		1939	
Aug. 16	3,201	Aug. 17	2,746	Aug. 19	2,454
Aug. 9	3,196	Aug. 10	2,743	Aug. 12	2,413
Aug. 2	3,226	Aug. 3	2,762	Aug. 5	2,413
July 26	3,184	July 27	2,761	July 29	2,342
July 19	3,162	July 20	2,681	July 22	2,378
July 12	3,141	July 13	2,651	July 15	2,403
July 5	2,867	July 6	2,425	July 8	2,145
June 28	3,121	June 29	2,660	July 1	2,396
June 21	3,056	June 22	2,654	June 24	2,362
June 14	3,066	June 15	2,665	June 17	2,310
June 7	3,042	June 8	2,599	June 10	2,329

Per Cent Change from Previous Week

	Week Ending		
	Aug. 16	Aug. 9	Aug. 2
New England	+23.0	+21.9	+22.9
Mid-Atlantic	+13.2	+15.5	+16.9
Central Industrial	+19.4	+21.0	+21.7
West Central	+17.5	+19.5	+14.6
Southern States	+21.8	+15.9	+16.4
Rocky Mountain	+ 3.1	+ 5.4	+ 5.4
Pacific Coast	*+ 9.0	*+ 8.7	*+ 8.3
Total United States	+16.6	+16.5	+16.8

* Percentage should be higher—data under revision.



Daylight Saving Fails to Affect Consumption

The daylight saving policy has not brought any perceptible reduction in power consumption in territory served by Duke Power Co.

Charles I. Burkholder, vice-president and chief engineer of the company, says the aggregate of consumption is holding up to recent high level. He stated that some saving of power might have resulted in some quarters from the daylight saving plan recently initiated in the Carolinas, but if so it has been offset by increased consumption in other quarters.

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Bonneville Asks $856,000

The Department of the Interior has been asked by Paul J. Raver, Bonneville administrator, to request an immediate appropriation of $856,000 to cover cost of constructing a 60-mile, 115,000-volt transmission line between Colfax and Spokane, Wash., with necessary substation equipment.

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Rehearing Plea Denied

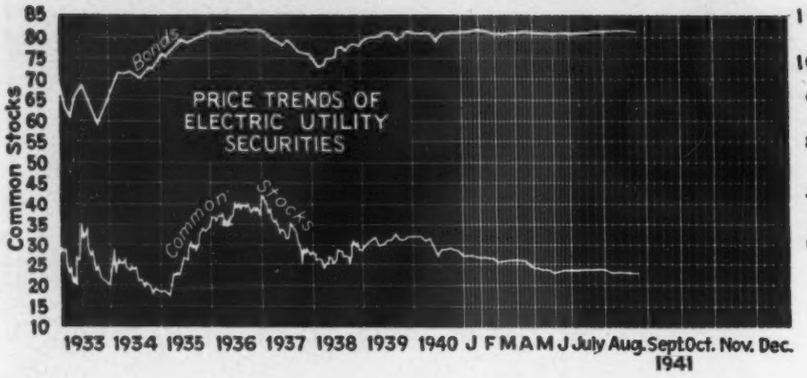
Wisconsin Public Service Commission has issued an order denying the city of Milwaukee a rehearing in the proceedings in which the commission recently permitted the Wisconsin Electric Power Co. to shift $3,300,000 from its depreciation reserve. The board stamped as "without any sound basis" an apparent fear on the part of the city that the transfer might operate to justify an increase in the rates charged by the power company or prevent a decrease in those rates, which would otherwise be possible and justified.

Expansion Plan Approved for Municipal Plant

An outlay of about $200,000 has been approved by a special town meeting at Hudson, Mass., for enlargement of the generating plant of the municipal light department, and an order has been placed for a 2,100-kw. Westinghouse generator to be direct-driven by a vertical 3,000-hp. Busch-Selzer, nine-cylinder (20½ x 27½-in.) Diesel engine at 240 r.p.m. The new generating unit will cost about $170,000 and the building addition, on the south side of the present station, about $25,000, according to a statement by Manager T. A. Walsh to ELECTRICAL WORLD. The machine is to be installed next spring and the generator will be designed to operate at 2,400 volts delta or 4,160 Y.

At present the plant has five Diesel units aggregating 3,500 kw. Arthur L. Nelson Engineers are consultants.

Utility Stocks and Bonds Lose Ground


Common Stocks
85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10
Bonds
110 100 90 80
PRICE TRENDS OF ELECTRIC UTILITY SECURITIES
Bonds
Common Stocks
1933 1934 1935 1936 1937 1938 1939 1940 J F M A M J July Aug. Sept. Oct. Nov. Dec. 1941

Electric light and power securities moved within a narrow range during the past week. "Electrical World" stock index dipped to 23.3 from 23.4 last week; last year, 28.6. Bonds also turned downward—"Electrical World" index, 105.7, last week, 105.8

Utilities Amend SEC Registration

Mississippi Power Co. and Gulf Power Co., subsidiaries of the Commonwealth & Southern Corp., have filed with the Securities and Exchange Commission amendments to their application to issue and sell bonds to the Reconstruction Finance Corporation to facilitate defense expansion.

Mississippi Power will reduce the amount of bonds which it will sell to the RFC to $2,750,000 from $3,250,000. Gulf Power will reduce the amount of the bonds it will sell to $3,100,000 from $3,600,000. Mississippi Power will issue and sell to the public $8,927,500 of new thirty-year 3½ percent first mortgage bonds as a permanent financing program to be used to redeem $6,177,500 of bonds held by the public and as much as $2,750,000 of bonds as may have been issued to the RFC. Mississippi Power will reduce the stated value of its common stock to $4,500,000 and will issue to the public $5,600,000 of new 3½ percent thirty-year first mortgage bonds for a similar purpose. Gulf Power will reduce the stated value of its common stock to $1,665,655 from $2,665,000. Hearings in connection with these applications will be held on August 28. To be considered in the case of Gulf Power will be whether the payment of common stock dividends by the company and other payments to its parent, the Commonwealth & Southern Corp., should be restricted for the purpose of enabling the company to have ample funds to meet its construction requirements and to establish adequate working capital.

Last week Justin R. Whiting, president of Commonwealth & Southern, announced plans for the financing program for the company's two subsidiaries. An integral part of the program involved the donation by Commonwealth of $5,332,789 as a capital contribution to the two properties in order to improve their financial structures.

Each company plans the construction of a new 20,000 kw. generating station, the one in Mississippi to be located at Hattiesburg, the other in Florida at Pensacola.

•

Approves Refunding Plan

Securities and Exchange Commission has approved a declaration by the Wisconsin Power & Light Co. for the issuance of $30,000,000 of 3¼ percent first mortgage bonds, series A, and $3,000,000 of 2¼, 2¾ and 3 percent unsecured notes. Proceeds are to be used toward the redemption of $33,000,000 of 4 percent first mortgage bonds, series A.

Must Admit Evidence

Securities and Exchange Commission has held admissible as evidence certain documents offered by the SEC utilities division in the Electric Bond & Share Co. proceeding under section 11 of the Holding Company Act. The company claimed that part of the material was confidential and should be included in the attorney-client privilege and also disputed the competency of documents which, it stated, were unchecked, preliminary in form or inaccurate.

•

Counsel Agrees on Delay

U. S. District Court clerk's office in Wilmington, Del., has announced a stockholders meeting of North American Light & Power Co. scheduled for August 21 had been postponed by agreement of counsel until October 21, pending adjudication of a Securities and Exchange Commission request for an injunction directed against the North American Co.

•

Utility Merger Proposed

NY PA NJ Utilities Co. and its subsidiary, the Associated Power Corp., have filed with the Securities and Exchange Commission an application regarding a proposal to merge the subsidiary with the parent, the latter acquiring all the subsidiary's assets and assuming all its liabilities.

Utility Reports

	Net Income 1941	1940
*Buffalo Niagara Electric	$4,221,419	$3,500,537
*Calif. Oregon Power	1,063,561	914,678
†Electric Power & Lt. and subs.	5,595,547	6,325,010
*Gulf States Utilities	2,381,384	2,819,529
*Idaho Power	1,508,530	1,469,609
*Kansas City Pwr. & Lt.	3,675,486	3,833,422
*Kansas Gas & Electric	1,623,029	1,286,857
*Louisville Gas & Elec. (Ky.) and subs	3,002,218	2,869,334
*Mississippi River Pwr.	1,482,658	1,167,995
*Nebraska Power	1,728,762	1,642,430
*Niagara, Lockport & Ont. and subs	1,115,419	1,609,144
*Oklahoma Gas & Elec.	2,690,388	2,718,652
*Pacific Pwr. & Lt. and sub.	936,142	860,160
*Puget Sound Pwr. & Lt. and subs	1,453,959	1,558,175
*Washington Water Pwr. and sub	2,327,296	3,231,753

*Twelve months ended June 30.
†Twelve months ended April 30.

New Issues of Electric Light and Power Securities in July

Name of Company	Amount (Par Value)	Offered to	Period (years)	Class	Purpose	Interest Rate	Price	Per Cent Yield
Coast Counties Gas & Elec.	$3,500,000	Placed privately	30	1st mtge. bonds	Refunding	3¼	104¾	3.008
N. Y. State Elec. & Gas	35,393,000	Placed privately	30	1st mtge. bonds	Refunding	3¼	104.015	3.04
	12,000,000	Public	—	Cum. pref. stock	Refunding and construction	5.10	103.50	4.93
Total	$50,893,000							

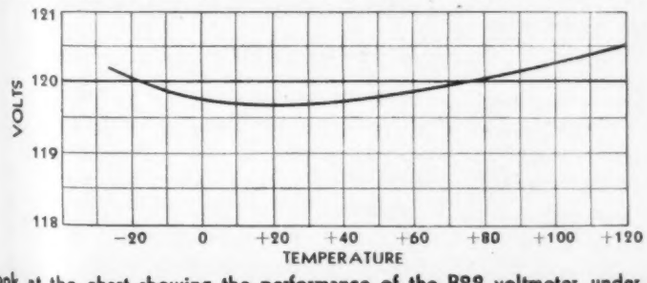
It's the G-E formula for closer, more profitable feeder-voltage regulation

WHY can G-E induction voltage regulators maintain *effective* feeder-voltage band widths of 2 volts as contrasted to bands of 4 volts or more held today on many feeders by regulators of other types?

The answer—based on fundamental engineering facts—is simple and logical.

1. **No Time Delay.** The induction regulator acts immediately to correct the voltage as soon as a voltage fluctuation touches the edge of the band. Regulators requiring a time-delay mechanism cannot act until the *average* voltage has been outside the band-width setting for a time equal to the time delay.
2. **Simplicity and Accuracy of Control.** With the G-E contact-making voltmeter, adjustments for voltage level, band width, and holding effect are independent of one another. The value to which any of them is set is not affected by changes in the settings of the other two.

   Once the settings are made, the G-E voltmeter can be relied upon to hold band width accurately. Proof of its accuracy is to be found in the practically flat temperature-accuracy and frequency-accuracy curves.



Look at the chart showing the performance of the B22 voltmeter under temperature variations of 140 F. Note that the maximum error—one-half volt—is approached only at temperatures above 110 F.

Compare this curve with those for other contact-making voltmeters and you'll see one important reason why G-E regulation is better regulation.

How the 2-volt advantage improves system operation

THE advantage of the narrower band width—2 volts instead of 4—held by the G-E induction regulator can be evaluated in several different ways, depending on feeder conditions. For example, it will allow a 15-per-cent extension—1500 feet on a typical feeder—with the same voltage difference between the first and last transformer. Or, it will permit increasing the load—by 500 kva on a typical feeder. In other cases it can be used to recover revenue lost because of voltage drops.

It will pay you to ask your G-E representative to show you just how much extra return you can obtain from G-E induction regulators. He will evaluate the advantage in terms of feeder extensions, increased load capacity, or reduced revenue losses. General Electric Co., Schenectady, N. Y.

GENERAL ELECTRIC

494-25-5400

OPERATING PRACTICES

New Treatment Given 110-Kv. Line Cedars

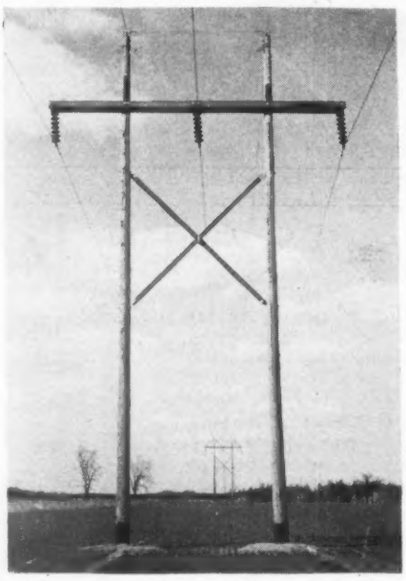
JOHN M. DRABELLE
Electrical and Mechanical Engineer
Iowa Electric Light & Power Company,
Cedar Rapids, Iowa

An extensive program calling for additional power generating facilities at Cedar Rapids, Marshalltown and Boone also involves interconnecting them in three steps with a 115-kv. line, extending from Cedar Rapids to Boone, Iowa, a distance of approximately 122 miles.

The type of construction adopted for the first section is the conventional H-frame construction, the average span being 660 ft. between structures on tangents. Spacing of conductors will be 13 ft. 6 in. in a horizontal plane. Insulators selected are the Ohio Brass Catalog No. 34500, seven insulators in suspension position and eight in strain position. The conductor will be a composite copper-copperweld cable, having an outside diameter of 0.465 in., consisting of nine copper strands and three copperweld strands. For lightning protection two copperweld ground wires of the extra high strength, 30 percent type, having an outside diameter of $\frac{1}{2}\frac{1}{2}$ in., will be used. The crossarms and associated fittings will be furnished by Hughes Brothers of Seward, Neb.

Poles will be A.S.A. Class 3, 55-ft. Western red cedar, used on the level tangents with the new "Life-Span" treatment. In order that the poles may last as long as the other elements of the line which must resist obsolescence, inadequacy and depreciation, this new treatment was selected so as to give the same life above the ground that creosote and incising give the pole at the ground line and below.

In the pole yard the preparation of the pole for treating follows the ordinary, established procedure, namely, roofing, framing, boring and the incising at the ground line. The entire pole, full length, is treated by the process,* which is a development of the research work of John P. Wentling and J. D. Burnes of Minneapolis.



H-FRAME line poles have pentachlorphenol treatment

The poles are then placed in a long, horizontal tank, buried in the ground until a predetermined amount of pentachlorphenol has been absorbed by each cubic foot of sapwood. After this absorption has taken place the remaining solution is pumped back into the storage tanks and wood samples are taken by increment borers. These samples are taken to the laboratory and the amount of absorption of pentachlorphenol is determined by standard laboratory procedure.

After the poles are removed from the pentachlorphenol bath and drained of surplus solution they are taken to the creosote tanks and treated for ground line protection in the conventional manner. Evidence indicated that the pentachlorphenol increases the toxicity of the creosote used in the ground line treatment.

Our findings show that on account of the high insolubility of the material it will not leech out of the pole. The synthetic resin used as a plasticizer prevents the "blooming" of the material on the surface of the pole.

Special storage precautions formerly taken with cedar poles not treated with the "Life-Span" process are no longer necessary on account of the high toxicity of the treatment employed. Poles may be unloaded from the car and onto the ground with no danger of infection. Similarly, poles may be distributed along the right-of-way with no fear of infection and left indefinitely.

* See "A New Treatment for Cedar Poles," "Electrical World," July 26, 1941, page 122.

Transformer Platform for Joint Use

Special precautions have been taken by Public Service Company of Colorado in designing alley-type transformer platforms on lines joint with the telephone company to provide ample and safe working space for telephone linemen installing cables or splicers repairing cables. Typical of the construction used is the 2,300-, 4,000- or 6,000-volt platform shown in the accompanying drawing from the company's distribution construction

A "SERVICE TRIP" in 1 second

RECLOSING CUTOUTS RESTORE SERVICE IMMEDIATELY SAVE OUTAGE COSTS—

Even the world's fastest trouble crew couldn't compete with a G-E reclosing fuse cutout for speedy restoration of service. *One second* after a temporary fault blows the first fuse link, this cutout automatically closes the line through a second link and drops a red indicator into view to show it has operated. And it does all this so quickly that motors continue in operation.

Almost as speedy is the job of *installing* G-E reclosing cutouts, if you're already using G-E indicating cutouts. Just replace the single-element doors with reclosing doors (a one-minute job using the new G-E jumper stick). Usually this has no effect on your co-ordination set-up.

Give G-E reclosing cutouts a trial on some of your important lines or hard-to-reach locations. You'll find they're the money-saving way to give your customers better service—in fact, *they can pay for themselves the first time they operate!* Ask your G-E representative to show you a sample—or write for Bulletin GEA-3448. General Electric, Schenectady, N. Y.

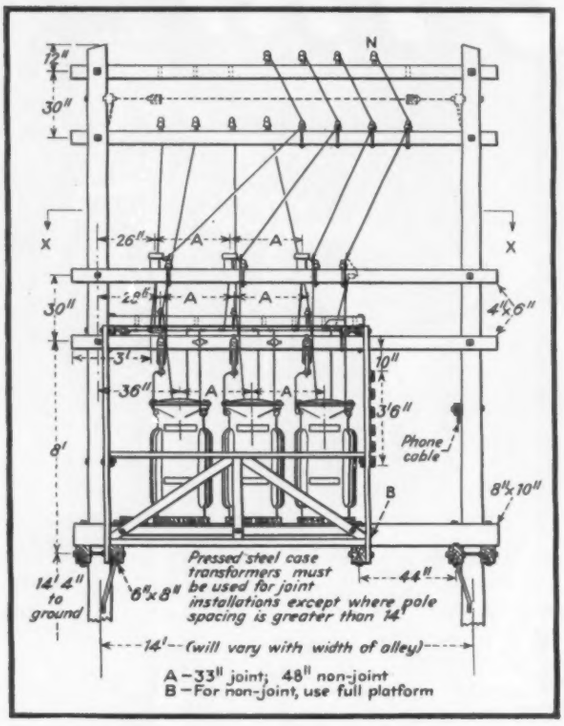
FORMULA FOR CUTOUT FLEXIBILITY

The G-E reclosing door is one of five standard items in the G-E Formula for Cutout Flexibility. Two others are the single-element door and the disconnect door All three doors fit the housings of both the 50-amp, 5-kv cutout and the 50-amp, 7.5-kv cutout Here's maximum flexibility, interchangeability, standardization. Here are two housings and three doors—*five items in all*—to fill 80 per cent of all distribution fuse cutout requirements.

A similar 2-housing, 3-door combination in the 100-amp rating is available for the other 20 per cent. Complete cutouts and separate doors are stocked for prompt deliveries.

GENERAL ELECTRIC

406-8-5254



ALLEY TRANSFORMER platform for joint telephone-power use

specifications. This platform will support from three 37½-kva. to three 100-kva. transformers. Particular attention is called (1) to use of slats used to separate the power portion of the platform from the cable portion, (2) to the ample working space (44 in. wide, 7 ft. high) adjacent to the phone cable, and (3) to complete absence of four conductors from the cable side of the structure.

•

Build Lines With 'Assembly Line' Method

By A. J. WATSON
Transmission Engineer
Mississippi Power Company, Gulfport, Miss.

Where unusual speed is not required, Mississippi Power Company has found that line construction can be most economically carried out by utilizing small crews, each of which specializes in a particular phase of the work. About fifteen structures can be set in a day by this method, and crews have set as many as twenty, unless it is necessary to dynamite too many poles into position or other uncommon circumstances are encountered.

Using this method, one crew hauls poles and crossarms as close to the final location as possible and distributes them from the truck. Another crew of several men, using a light Caterpillar type tractor, places the poles with their crossarms at the actual locations for the structures and lines them up for raising. About the same time a third crew comes through installing anchors. A fourth crew distributes hardware and insulators and completely assembles the structures on the ground. Thus each structure is complete when the crews leave —even to insulators hung on the crossarms and suspension clamps installed on the bottom of the string. Any guys that are to be installed are also fastened to the poles.

A pole-hole digging crew keeps about ten or fifteen structures ahead of the erecting crew, which consists of about sixteen men and uses a light Caterpillar-type tractor equipped with a winch. Structures are raised completely assembled by the fallinggin method, using a bridle that fastens to each pole near the point of attachment of the crossarm, with a tail line on each pole and two side lines on each structure. As the structure is raised into position it is lined up by the use of levels and tamped before any of the tail lines, side lines or tractor winch lines are slacked off. Then the one lineman in the erection crew removes the side lines, the equipment is loaded into a four-wheel steel wagon attached behind the tractor and is moved to the next structure.

If any difficulties are encountered in digging holes to the required depth because of quicksand or mud, structures are dynamited to the proper depth after they have been set up. To do this, a 1½-in. pipe plugged at the end with a sharpened locust pin, or, in some cases, a steel point, is driven into the ground a little deeper than the pole is to be set. After the dynamite charge has been lowered into the pipe it is held down with a rod so that the pipe may be removed. The pole gradually settles into the gas pocket formed at the base of the pole when the charge is fired. Usually the crews try to get the holes a little deeper than necessary so that the poles may be raised with pole jacks to the proper level.

Wire-Stringing Operations

The wire-stringing crew usually begins several weeks after the pole-erecting crew has begun its work. One small crew in this group goes ahead hanging up sag blocks and is followed by the crew that strings the conductors. Immediately behind is a third group that moves conductors from the sag blocks and places them in the suspension clamps after each reel of wire has been sagged. The crew that ties in the conductor usually has several groundmen in it that pull the guys to the proper tension and clamp them in.

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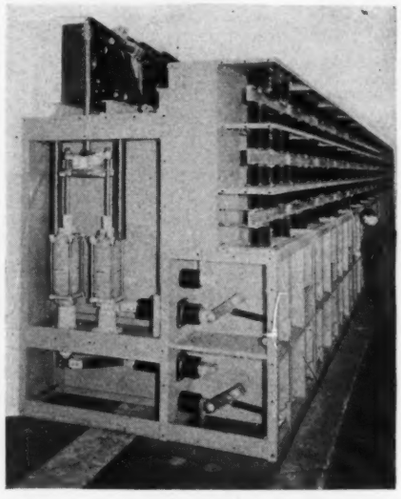
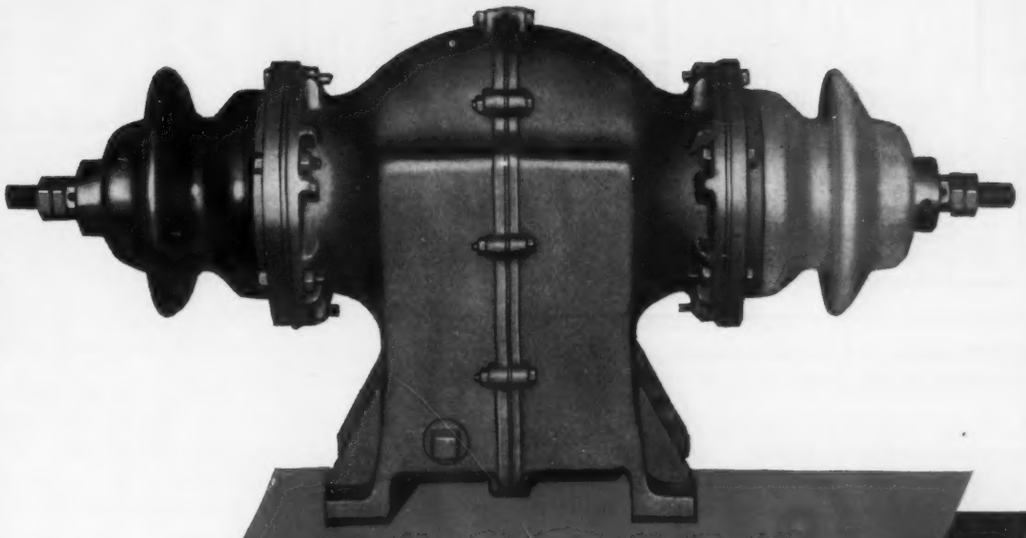
Steel Cubicles Save Weight



As part of the 1940 expansion in its Stamford power station Connecticut Power Company installed this type "FH" General Electric cubicle switchgear for oil circuit breakers, rated 15 kv., 2,000 amp. A comparable installation using concrete compartments to house the switchgear equipment would have required more than 154 tons of concrete for the circuit breaker cells and bus compartments. Weight of the concrete structures alone would exceed total weight of the steel cubicles, including switchgear, by more than 44 tons. Installa-



NOW POWER-LEVEL INSULATION IN A 15-KV C.T.

THIS G-E outdoor current transformer, Type JK-12, is adequately insulated—it passes the 110-kv, full-wave impulse-test requirement.

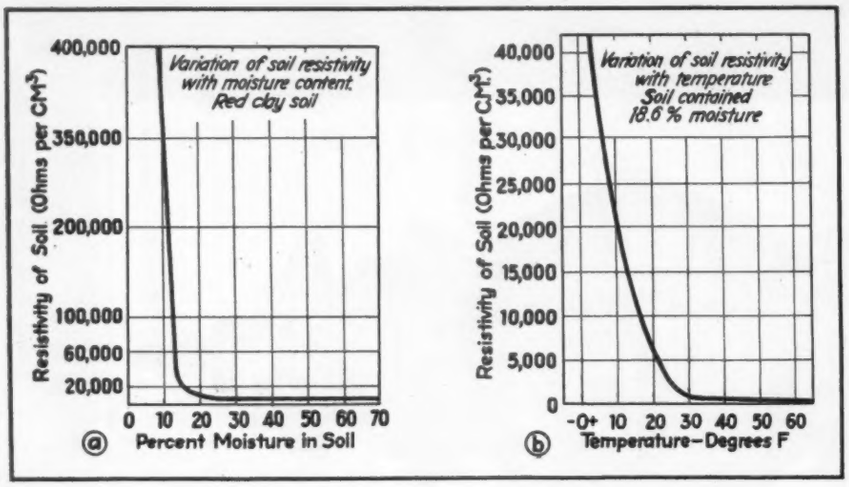
FOR BOTH METERING AND RELAYING

The 5- to 800-amp ratings of the Type JK-12 meet the highest-accuracy classification, $\frac{1}{4}X$, $\frac{1}{4}Y$, and $\frac{1}{4}Z$; the 1000- and 1200-amp ratings meet the $\frac{1}{4}X$, $\frac{1}{4}Y$, and $\frac{1}{2}Z$ classification. Its characteristics during overcurrent conditions make it particularly well suited for relaying as well as for metering. General Electric, Schenectady, N. Y.

CONSTRUCTION

Mounting—either vertical or horizontal • Case—aluminum (rustproof and requires no paint) • Compound filling—high dielectric strength • Primary bushing—undercut skirts provide great creepage distance • Primary terminals—threaded-stud type • Secondary terminals—fixed studs in a compartment with conduit connections

GENERAL ELECTRIC



SOIL RESISTIVITY varies with moisture content (a) and with temperature (b). Red clay soil is considered in both charts; in (b) the soil contained 18.6 percent moisture

Effect of Moisture Content on the Resistivity of Soil

Moisture Content Percent by Weight	Resistivity—in Ohms per Cm.³ Top Soil	Sandy Loam
0	1,000 x 10⁶	10,000 x 10⁶
2.5	250,000	150,000
5	165,000	43,000
10	53,000	18,500
15	19,000	10,500
20	12,000	6,300
30	6,400	4,200

Effect of Temperature on the Resistivity of Soil

(Sandy loam—15.2 percent moisture)

Temperature Deg. c.	Resistivity in Ohms per Cm.³
20	7,200
10	9,900
0 (water)	13,800
0 (ice)	30,000
—5	79,000
—15	330,000

tion of these units consisted of placing them in position side by side, joining the buses and connecting the terminal leads.

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Moisture, Temperature and Soil Resistivity

By J. R. EATON*
Purdue University, Lafayette, Ind.

The resistivity of a given sample of soil is dependent not only upon the chemical composition of the soil but also, to a very great extent, on the moisture content and the temperature of the soil. Accompanying tables and charts show these variations.

From the table on the effect of moisture content it may be seen that when thoroughly dried both samples of soil were very good insulators. Resistivities of the soils increased quite rapidly until, with 30 percent moisture content, the resistivity of one sample was 6,400 ohms per centimeter cube and of the other was 4,200 ohms per centimeter cube. From the data on effect of temperature it will be seen that a rather pronounced change in resistivity occurs in the region just below the freezing point.

Since the resistivity of the soil is so much dependent on moisture content and temperature, it is reasonable to assume that the resistance of any earth connection may vary considerably throughout the different seasons of the year. Again, since both temperature and moisture content become more stable at greater distances below the surface, it is apparent that, to be permanent, a ground connection should be constructed with the electrodes at an appreciable distance below the surface, preferably at the permanent moisture level.

In certain parts of the country, most notably in the glaciated areas, soil resistivity may vary greatly from one point to another in the same neighborhood. One study, in the Great Lakes area, of the value of ground resistance of consecutive towers on a transmission line showed resistance variations from 5 to 600 ohms over a relatively short distance.

[ED. NOTE—This is the third of a series of articles on grounding.]

* Consultant for James G. Biddle Co.

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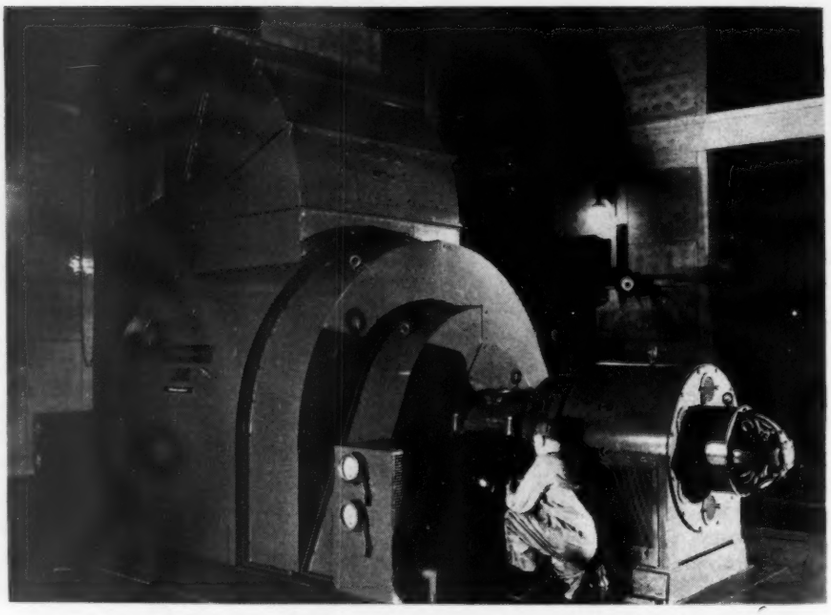
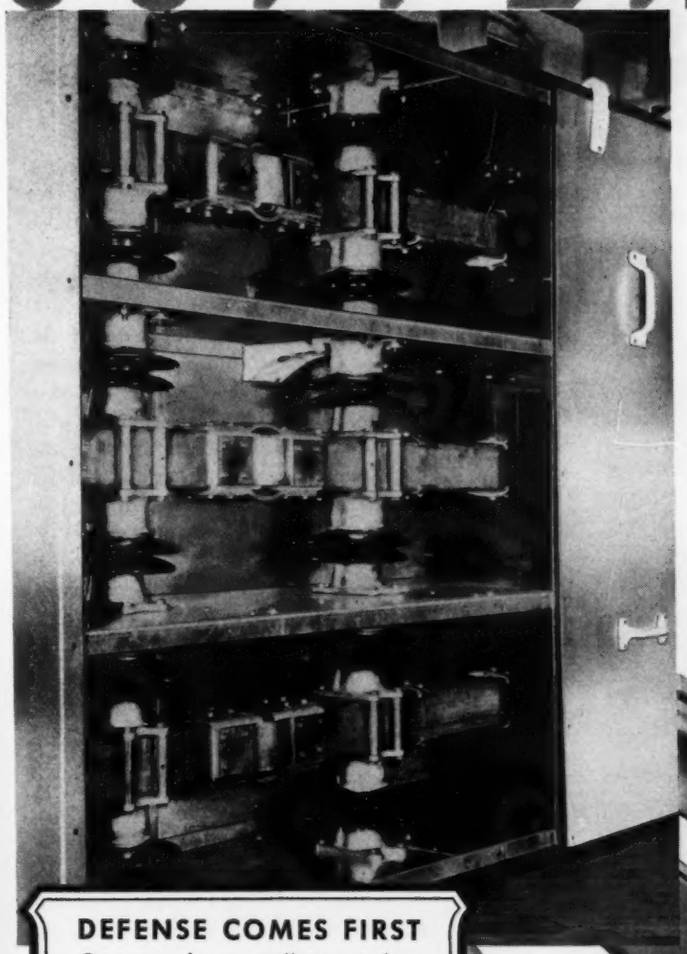
Precipitron for Synchronous Condenser



OHIO EDISON ventilates this 20,000-kva. synchronous condenser at the Gorge steam plant with electrically cleaned air at the rate of 40,000 cu.ft. per minute. Fifty-six Westinghouse Precipitron cells mounted in the air duct underneath the machine form the electrostatic air cleaner which removes from 85 to 90 percent of the dust and dirt from the incoming air. Air is forced upward from the floor underneath, through the machine and out the curving duct at the left. Engineers estimate the installation will remove between 50 and 75 bushels of airborne dirt in a year, an amount which, if blown into the machine, would make dismantling and cleaning by hand necessary at regular intervals for the removal of dust, dirt, smoke and soot.

COPPER

—means more efficient bus conductors



Because of its high conductivity and consequent low current losses, copper has always been the most widely used material for bus conductors. To these advantages may be added such further qualifications as high thermal conductivity, high strength, high resistance to corrosion and ready availability of accessory equipment. Thus it is that copper lends itself to more efficient bus constructions.

Wherever modern electrical engineering practice dictates bus construction embodying structural strength, low ohmic and reactance loss or effective heat dissipation, the range of copper bus shapes made by The American Brass Company will meet every requirement.

The complete line includes flat bars, tubes, cables and angles and channels for ventilated structures. Descriptive literature and advice of our technical staff are available on request. 41127

Photo at left courtesy I-T-E Circuit Breaker Company.

CHANNEL SQUARE
Maximum Current in Minimum Space

TUBULAR
Lowest Losses

ANGLE SQUARE
Maximum Current with Minimum cross section

DEFENSE COMES FIRST

Copper and copper alloys are playing an indispensable part in the National Defense Program. Recognizing the responsibility placed on us, we are exerting every effort to fulfill our part in the tremendous task created by the emergency. In the United States and Canada, our ten plants serving important industrial centers are working to the limit of their ability to increase the output of products for which the demand is greatest. We feel sure consumers will appreciate the problems which confront us and will cooperate fully in our efforts to plan production beyond defense requirements so that all customers will receive every consideration.

ANACONDA

Anaconda Copper

THE AMERICAN BRASS COMPANY • General Offices: Waterbury, Conn.
Subsidiary of Anaconda Copper Mining Co. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

INDUSTRIAL ENGINEERING

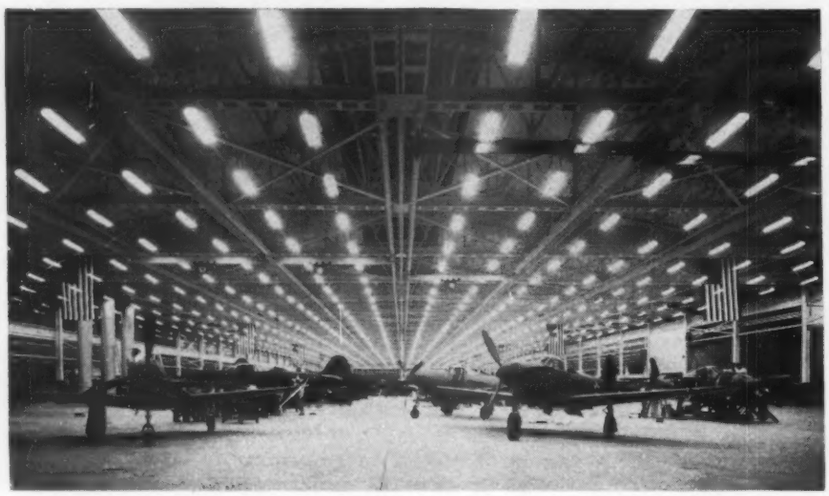
D.C. Fluorescent for Aircraft Plant

A network of underfloor ducts houses service facilities at the new Bell Aircraft Corporation assembly plant at Niagara Falls, where a conveyorized layout was adapted to permit a maximum output of Airacobra planes with a minimum investment in special fixtures. Fluorescent lighting has also been adopted to take over the job of illumination at dusk; to make the lighting most efficient, interior walls and structural steel are all painted white. The plant is not a so-called "blackout" plant.

Underground service trenches carry 110-volt and high-cycle power and compressed air lines to more than 300 outlet boxes throughout the plant. These are spaced on 25-ft. centers throughout the major portion of the plant and 15 ft. apart along each of the four final assembly lines. Additional outlets are provided on the columns and at certain overhead points.

A new type of rectified fluorescent luminaire, developed by General Electric Company for high-bay illumination, and said to have been used for the first time here, has been installed at 720 positions down the center of the plant, where two assembly aisles open into an unobstructed area 200 ft. square at the airport end of the plant. These two-lamp units, installed on 12-ft. centers 30 ft. above the production floor, are designed to give a minimum of 30 ft.-candles on the working plane. A special circuit installed in the luminaires themselves rectifies the a.c. supply to d.c.

Comparable lighting intensity is provided for sub-assembly work in the two 50-ft. bays on either side of the final assembly area. There two-tube Hygrade-Sylvania fluorescent Mazda units are grouped end to end, 2 ft. apart, so that the tubes parallel the production line in two rows 16 ft. apart. In bays on the south, where provision has been made for future construction of a mezzanine, these units are mounted at a height of 19 ft. 6 in. On the north the units are mounted at a height of 12 ft. 5½ in.

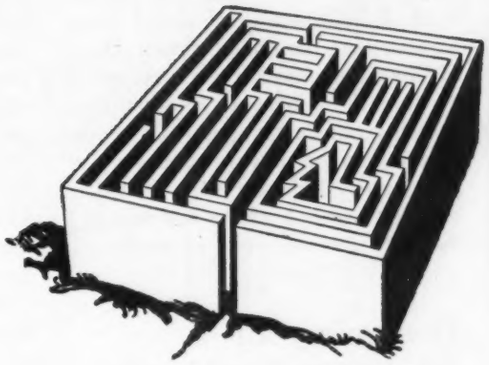


RECTIFIED FLUORESCENT two-unit luminaires, installed on 12-ft. centers 30 ft. above the production floor, provide 30 ft.-candles on the 200-ft. wide central assembly area of Bell Aircraft Corp. conveyorized assembly plant (below). Underground service ducts carry 110-volt and high-cycle power and compressed air lines to outlet boxes spaced 15 ft. apart along final assembly lines (above), on 25-ft. centers in rest of plant

•

Dry Control Boxes With Infra Red

By reducing the drying time between steps in the finishing of control boxes at the Milwaukee plant of the Allen-Bradley Company, three modern infra-red drying tunnels, grossing 104 kw., have contributed to making the finishing process more continuous and thereby increased the department's production rate. Unfinished boxes pass through the process on a continuous conveyor and are successively washed and rust-proofed, given an over-all coat of black enamel, and a coat of white enamel inside. Tunnels



There IS a Way Out

Put your bewildering puzzle of fitting Defense Supply into Defense Demand squarely up to your local T & B Distributor. If anyone can find the quick, economical and safe way out of your specific problems, he is the man to consult.

RIGHT NOW

The T & B Distributor can locate sources of strategic supplies unknown to many Defense buyers.

He is backing up twenty-four hour production with twenty-four hour deliveries on vital products. Practically every order is an emergency order.

He provides known and acceptable alternatives for materials unavailable through regular channels of supply.

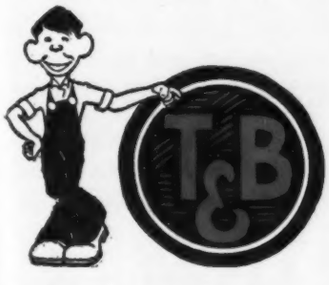
He offers quick access to dependable technical information.

Yours for the asking, he also has time-and-money-saving shipping information.

He tactfully prevents newcomers in construction work from taking costly missteps.

In short, the T & B Distributor adjusts means to ends, "finds the way out" and saves priceless time on this Country's Number One Job of National Defense.

Operating under The T & B Plan, we are doing everything in our power to strengthen and perpetuate what we believe to be the only economically sound system of distributing electrical products—through Wholesalers.



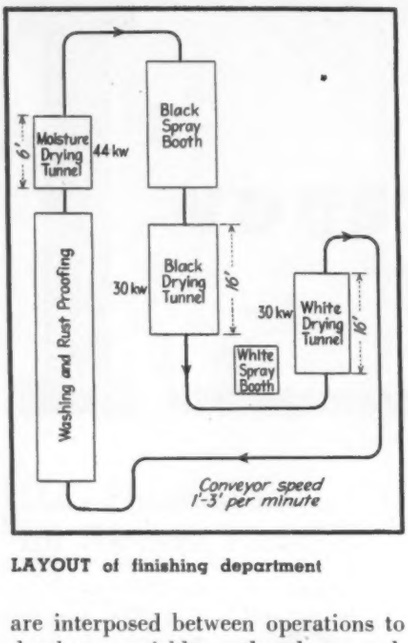
THE THOMAS AND BETTS CO., INC.

MANUFACTURERS OF ELECTRICAL FITTINGS SINCE 1899

T&B Distributors cover United States and Canada

Factory, Engineering and Executive Offices, Elizabeth, N. J.

Sales and Service offices in 23 leading cities



LAYOUT of finishing department

are interposed between operations to dry boxes quickly as they leave each step in the process outlined in the accompanying schematic sketch.

From the washing and rust-proofing booth boxes enter a tunnel of 44-kw. capacity, consisting of two vertical banks of sixty 250-watt tungsten PS-30 infra-red lamps in 10-in. Hall hexagonal reflectors arranged in six horizontal rows of ten each, approximately 36 in. apart. At the bottom of this tunnel are two rows of seven 1,000-watt concentrating units with glass lenses. This tunnel is 6 ft. long and the conveyor passes through it at a speed of 1 to 3 ft. per minute, boxes emerging dry and ready for the first (black) paint spray booth.

Air Circulation

From the black spray booth the boxes, suspended from the conveyor, pass to a 30-kw. tunnel, which differs from the previous one in that the lamps are arranged to form a tunnel of roughly elliptical section 36 in. wide, 48 in. high inside and 12 ft. long. The tunnel is made up of twelve rings of ten PS-30 lamps each, mounted in hexagonal reflectors, each being affixed to sockets in the wireway that makes up each ring.

Both the black and the white drying tunnels are of identical design, each is provided with an inclosure along the top and bottom to control circulation within the tunnel; also, at each end a 29-in. elliptical extension to the tunnel is provided to reduce the circulation of air through the tunnel in an axial direction. It has been found that the shield has raised the temperature inside the tunnel 3 to 4 percent. Temperature in the tunnel is 300 deg. at a point about two-thirds of the way through.

To prevent control boxes on the conveyor from damaging either lamps or fixtures as they pass through, each tunnel is provided at the entering end with an elliptical bar guard 2 in. smaller than the tunnel section. Boxes striking this guard trip a limit switch to stop the conveyor. Another limit switch arrangement operated by hooks attached to the conveyor turn the drying lamps "on" and "off" ahead of the first and behind the last box of a batch to prevent waste of energy.

•

Designing for Minimum Shutdowns

The need of thorough engineering analysis to prevent costly shutdowns in industrial plant electrical distribution systems augmented by inadequate layouts was recently illustrated in the practice of the Hartford Steam Boiler Inspection & Insurance Company. Following the stalling of a 250-hp. motor due to the jamming of a driven machine, the motor itself was damaged from overheating, and leads and cables near the motor were burned and grounded. The insulation of these had been weakened by liquid used in the manufacturing process. The motor failure caused a phase-to-phase short across the buses of a 16-cubicle distribution switchboard, a circuit breaker burnout and overheating and breakdown of feeder cables from the main source of supply. Emergency repair measures followed, utilizing a duplicate motor, spare parts and other equipment, but in resuming production a bus short occurred at the supporting insulators, due to moisture absorption during four days when the plant was out of commission, and trouble occurred in cable in conduit close to circuits damaged from overheating in the previous upset. A total of $5\frac{1}{2}$ days elapsed before manufacturing got well under way, and later another stoppage of $1\frac{1}{4}$ days over a week-end was required to complete the installation of new 2,300-volt cables and replacement of temporarily repaired switchboard parts.

The total cost of the interruption was about $45,000 in lost production and about $6,000 for repairs. The outstanding lessons of the failure for the engineer concerned with industrial plant electrical design were (1) the widespread damage and delay which may result from the breakdown of even a small piece of electrical apparatus (such as the breaker in the motor supply circuit); (2) the importance of circuit breakers having ample interrupting capacity to open in case severe faults should occur in their controlled circuits; (3) the danger in an installation consisting of several circuits of different voltages in one junction box where the failure of one may seriously damage the others (in this case there were 2,300-, 440- and 125-volt cables concerned), and (4) the importance of special attention to bus insulation in damp locations.

Provision of cable coverings either beyond reach of destructive chemicals or of composition and housing capable of resisting such elements was emphasized as important. Circuit breaker ratings and capacities were also found to be as important as cubicle construction, valuable as the latter is. The interruption was characterized by a long series of mishaps which pointed toward a greatly improved future layout, but at the expense of a costly engineering lesson.

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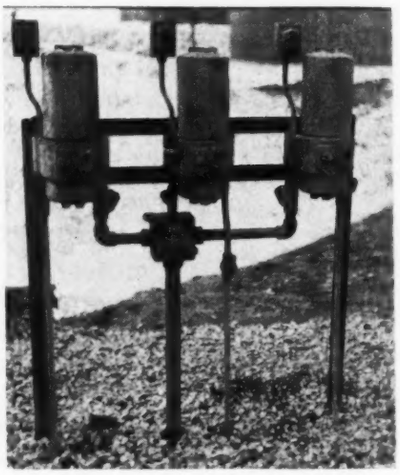
Outdoor Mounting For Motor Controls



A neat and accessible outdoor mounting arrangement for combination motor starters and breakers of the explosion-proof type, using a simple and inexpensive angle iron framework, is shown as used by the Wisconsin Oil Refinery Company, Sheboygan. Controls are for nearby treating pumps and an air compressor.

Check these advantages

	NEW LOSS RATIO	LOW EXCITING CURRENT	GOOD REGULATION AT 100% P.F.	GOOD REGULATION AT 80% P.F.	IMPROVED SURGE STRENGTH	LARGE COIL AREA FOR COOLING	WOUND TYPE CORE	ROUND COILS
L-M ROUND-WOUND TRANSFORMER	YES	YES	YES	YES	YES	YES	YES	YES
YOUR 1ST CHOICE TRANSFORMER								
YOUR 2ND CHOICE TRANSFORMER								
YOUR 3RD CHOICE TRANSFORMER								

Write in the name of the transformer YOU think best. Fill in "yes" or "no" in each column. We want YOUR opinion.

Today YOU CAN HAVE THE "TRANSFORMER OF TOMORROW"

Here is an opportunity for you to pass your judgment on new developments in distribution transformers.

We know the L-M ROUND-WOUND Transformer is the "transformer of tomorrow."

We know it because WE can put "yes" after the name "L-M ROUND-WOUND Transformer" in every column of the chart above.

Now see what you can do with the transformer that you THINK offers you the most. If you like crossword puzzles, you'll enjoy doing this. And we would like to have your opinion.

LINE MATERIAL COMPANY

LM

NEW ENGINEERING IDEAS

Tester for R I Demand Registers

To facilitate testing and adjusting registers of Westinghouse type R I kva. demand meters a device was designed and constructed by Walter A. Studier, electric meter department, Rochester Gas & Electric Corporation, and on which he has applied for patent. It consists of a frame which supports the register to be tested, a spring motor with a suitable gear train which drives either or both sides of the register as required, a revolution counter which automatically stops the spring motor after a predetermined number of revolutions have been made and a scale on which the register pen arm indicates. There is also a detachable gauge having two indicators which show any error in the positions of the disks which drive the ball mechanism.

The register to be tested is removed from the meter and placed in the testing device, where it is held in position by a spring latch at each end. Pinions mounted on shafts which correspond to the disk shafts in the meter drive the respective sides of the register. The conditions of 0, 0.707 lag or 1.0 power factor are simulated in the test by setting the selector (A in the illustration). The register can be rapidly and accurately checked both for kva. and kw. indications at four points on the scale for 0 and 1.0 power factor, and at three points on the scale for 0.707 power factor.

The spring motor is governed to a speed which is the equivalent of 10 r.p.s. of the meter disks, a speed which does not introduce slippage or ill effects in the register, yet permits reaching full scale deflection in less than two minutes. For comparison it might be noted that conventional meter testing methods using 150 per cent of rated meter load require about 25 minutes to produce full scale deflection. In cases where several adjustments are necessary and each must be checked at some point above half scale the time-saving possibilities become very apparent.

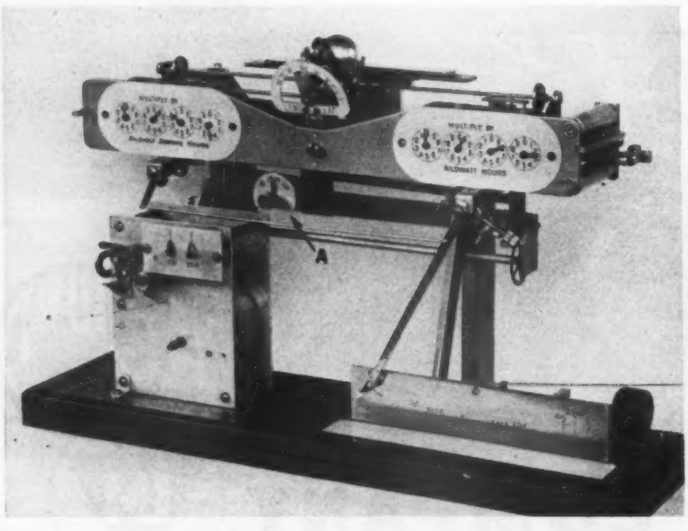
The dual indicating gauge provides a means of correctly positioning the driving disks and the positions of these disks are vitally important for correct kva. and kva.-hour registration. While the register is supported in the test device all adjustments on it are readily accessible, a fact which will be appreciated by any one who has handled these registers.

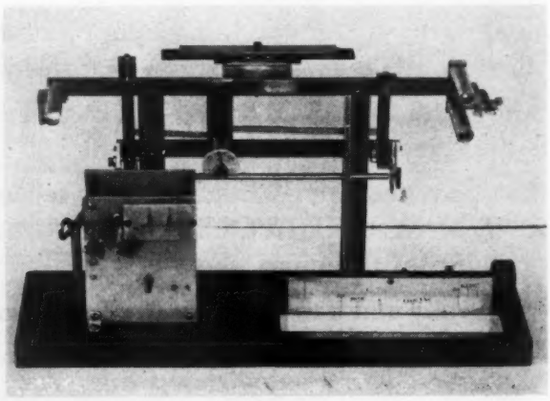
•

Transformer Measures Direct Current

Measurements of large values of direct current can be made by a "current transformer" instead of by determining the voltage drop across a shunt which is wasteful of power. Transformers, needed in connection with the production of aluminum, have been made for a full-load d.c. "primary" current of 50,000 amp. (ratio 40,000/10), according to *Electrical Review* (British).

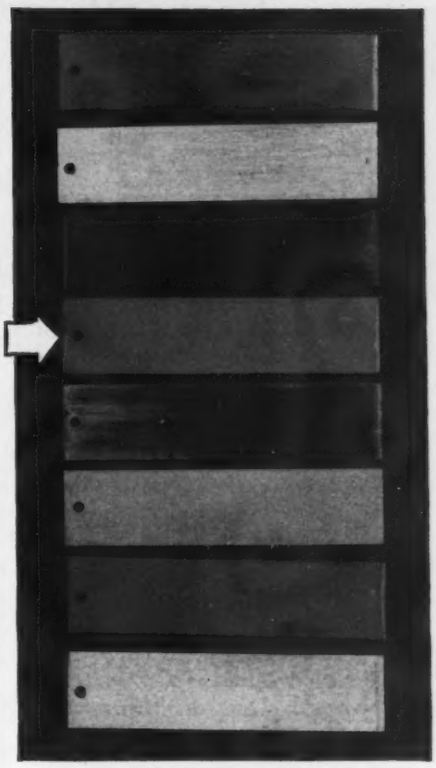
The principle of the transformer is





BALL-TYPE kva. meter register tested for scale and revolution errors (left). Above, the device itself with register removed. The spring motor gives a governed speed equivalent to 10 r.p.s. of the R I meter

Unknown to Us . . . *Large Public Utility Made an Amazing Test . . . *Then Told Us Why They Adopted* TRUSCON PARATEX Rubber-Base Metal Coating



Unretouched photograph of the eight panels.

A big public utility began to hear a great deal about PARATEX, the new rubber-base metal coating. This company became curious. They wanted to find out if PARATEX was as remarkable as word-of-mouth reports said it was. So they arranged for an exceedingly difficult test.

They selected their own steel (hot rolled), pickled it and cleaned it themselves. From it they made eight test panels and, choosing the best-known brands of steel paints on the market, including aluminums, they painted each panel with a different one of these paints.

Then they put the panels in a weatherometer where they were subjected to alternate wetting and drying, cold and heat, ultra-violet and actinic light. At the end of two and one-half months all the paints had failed except PARATEX and one aluminum. PARATEX alone, however, remained practically perfect. So now this company is standardizing on PARATEX Metal Coating.

The thing they liked about PARATEX Metal Coating was its adhesion and toughness of film. It's been said it is practically as good as galvanizing. But, besides adhesion and toughness of film, PARATEX has a brand new property which paints have never possessed heretofore. We call it "lateral absorption."

When PARATEX is applied over scales of rust and paint that do not have true adhesion to a surface, it has been found that PARATEX penetrates and works its way laterally under those scales. We are not exaggerating when we say it may be worth thousands of dollars to you to get the complete PARATEX story—how the "lateral absorption" of PARATEX offers you a check on the future protective qualities of your steel paint job. We will be glad to give you all the facts.

TRUSCON LABORATORIES
DETROIT, MICH.

* *Naturally this company would not permit us to use their name in connection with any advertising, but they have no objection to our telling you personally who they are.*

TRUSCON PARATEX

RUBBER-BASE METAL COATING

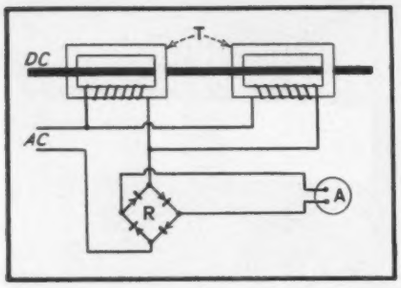
The Outstanding* PROTECTION *for All Types of* EXPOSED IRON *and* STEEL. It Gives Better Protection Against Rust and Lasts Longer . . . *Because It Is

MOISTURE-PROOF • FUME-PROOF
RESISTANT TO ACID AND ALKALI
GASOLINE AND OIL-PROOF • RUST AND
CORROSION-PROOF • WEATHERPROOF

Besides This*—IT'S QUICK DRYING—IT'S EASY TO APPLY—AND *IT'S ECONOMICAL

WRITE today for Bulletin 518 containing full information on this brand new development that's revolutionizing iron and steel protective coatings.

BRAND NEW! *Outlasts* PAINT!



CONNECTIONS for transformer (*T*), rectifier (*R*) and instrument (*A*), for measuring large values of direct current

based upon the fact that the a.c. magnetizing current taken by a reactance coil will increase rapidly when the reactance unit is provided with another winding through which direct current is passed.

This instrument transformer has two parallel cores, in order to deal with both halves of the a.c. wave. On each core the a.c. or "secondary" winding is wound in opposite directions, so that when the continuous and alternating fluxes are assisting one another in one core they are opposing one another in the other core. During a half-cycle the a.c. flux in one core will rise to a value just sufficiently above the d.c. flux to neutralize it and yet leave enough margin to induce the requisite back emf. During the same half-cycle, the other core will be saturated so that the half-wave of magnetizing current will be narrow and high.

The two currents are superposed upon one another, together providing a "secondary" (almost exactly proportional to the d.c. primary) that flows through a rectifier and to a d.c. ammeter.

•

Calculator for Street Lighting

By GAYLORD B. BUCK, Jr.
Engineering Department, General Electric Company, Nela Park, Cleveland, Ohio

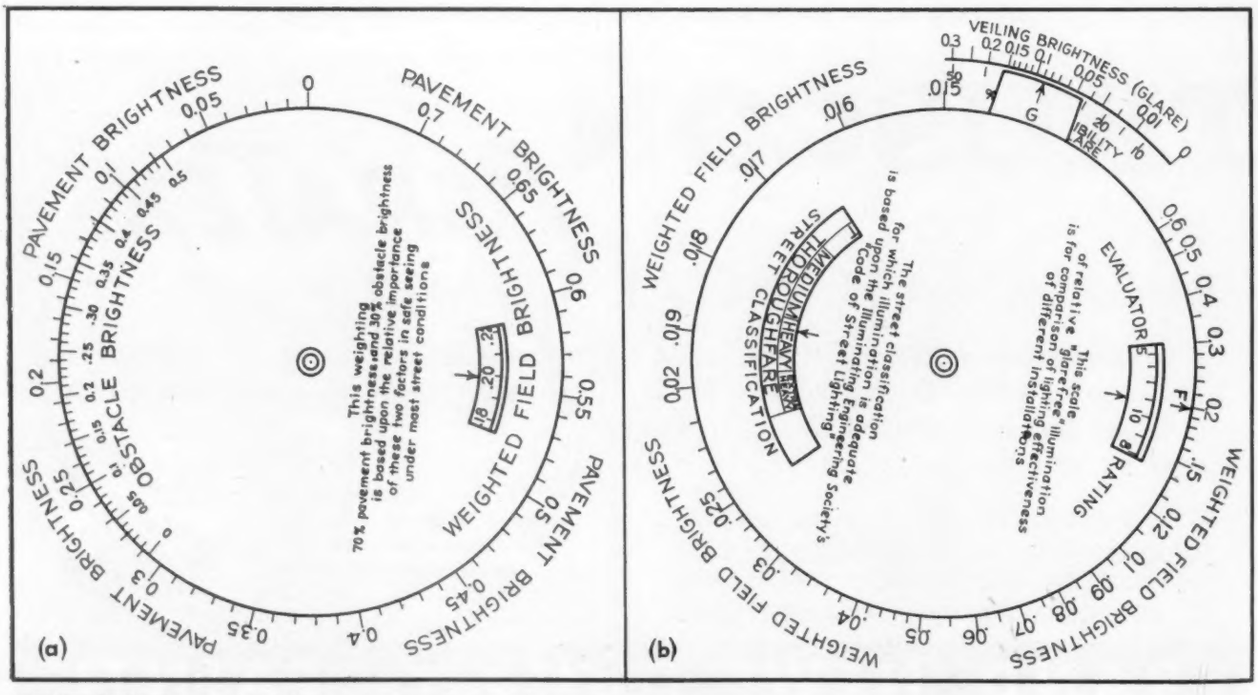
Effectiveness of a street-lighting system may be determined with the aid of the Street Lighting Evaluator recently developed by the Nela Park engineering department of the General Electric Company (ELECTRICAL WORLD, July 27, 1940, page 108, and August 10, 1940, page 88).

The original technique of combining the evaluator measurements employed a Street Lighting Evaluation Chart that weights the values of pavement and obstacle brightness in any desired proportion. Research and experience have shown that in the great majority of installations the relative importance of pavement and obstacle brightness is 70-30 per cent in terms of "seeing for safety." For most systems where the 70-30 weighting is indicated the illustrated calculator provides a simpler, faster and more accurate means of visibility computation.

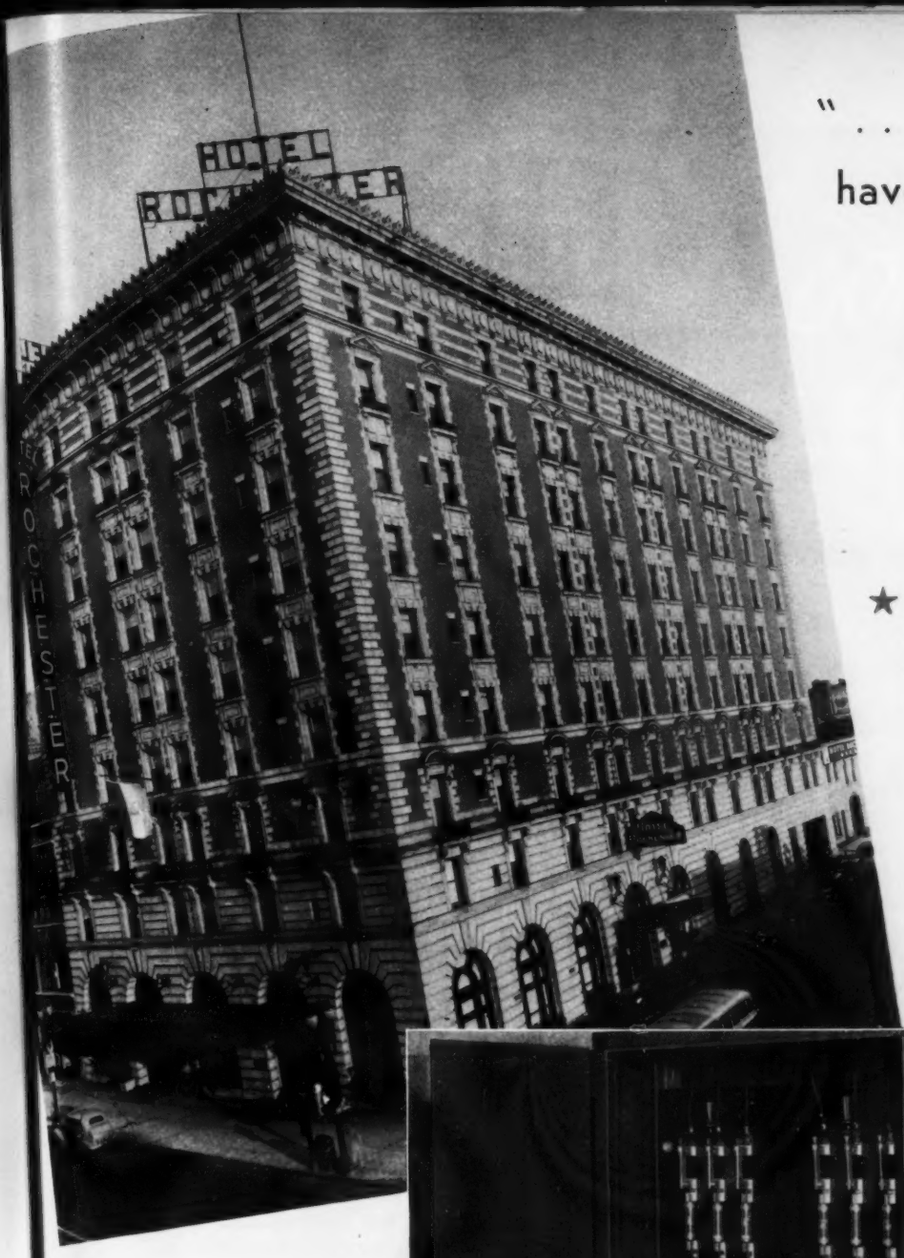
After values of pavement brightness, obstacle brightness and veiling brightness (glare) have been measured with the evaluator at representative test points on the street, the minimum and average values are used to compute minimum and average lighting effectiveness with the calculator as follows:

Using side (a), line up value of obstacle brightness (0.05 for example) with value of pavement brightness (such as 0.27) and read weighted field brightness through window (0.20). Turning to side (b) of calculator, set and hold pointer "G" on value of veiling brightness (here 0.085); then set pointer "F" on value of weighted field brightness 0.20 determined on side (a) and read "Evaluator Rating" and "Street Classification" through windows (Evaluator rating of 11.0 and classification of "Heavy Traffic" thoroughfare).

The evaluator rating is of particular interest to the engineer since it provides, for the first time, an adequate means of comparing different systems and a means of correlating accidents with visibility or determining the "factor of safety" in seeing. The "Street Classification" scale is based on the Illuminating Engineering Society's "American Recommended Practice of Street Lighting" and is of primary interest to the layman and non-technical official.


PAVEMENT BRIGHTNESS
OBSTACLE BRIGHTNESS
WEIGHTED FIELD BRIGHTNESS
This weighting is based upon the relative importance of these two factors in safe seeing under most street conditions
70% pavement brightness and 30% obstacle brightness
(a)
VEILING BRIGHTNESS (GLARE)
WEIGHTED FIELD BRIGHTNESS
EVALUATOR RATING
STREET CLASSIFICATION
MEDIUM THOROUGHFARE
HEAVY THOROUGHFARE
The street classification for which illumination is adequate is based upon the Illumination Code of Street Lighting" of the Illuminating Engineering Society's "American Recommended Practice
This scale is for comparison of lighting effectiveness of different installations
(b)

CALCULATOR for street lighting evaluator aids visibility computation

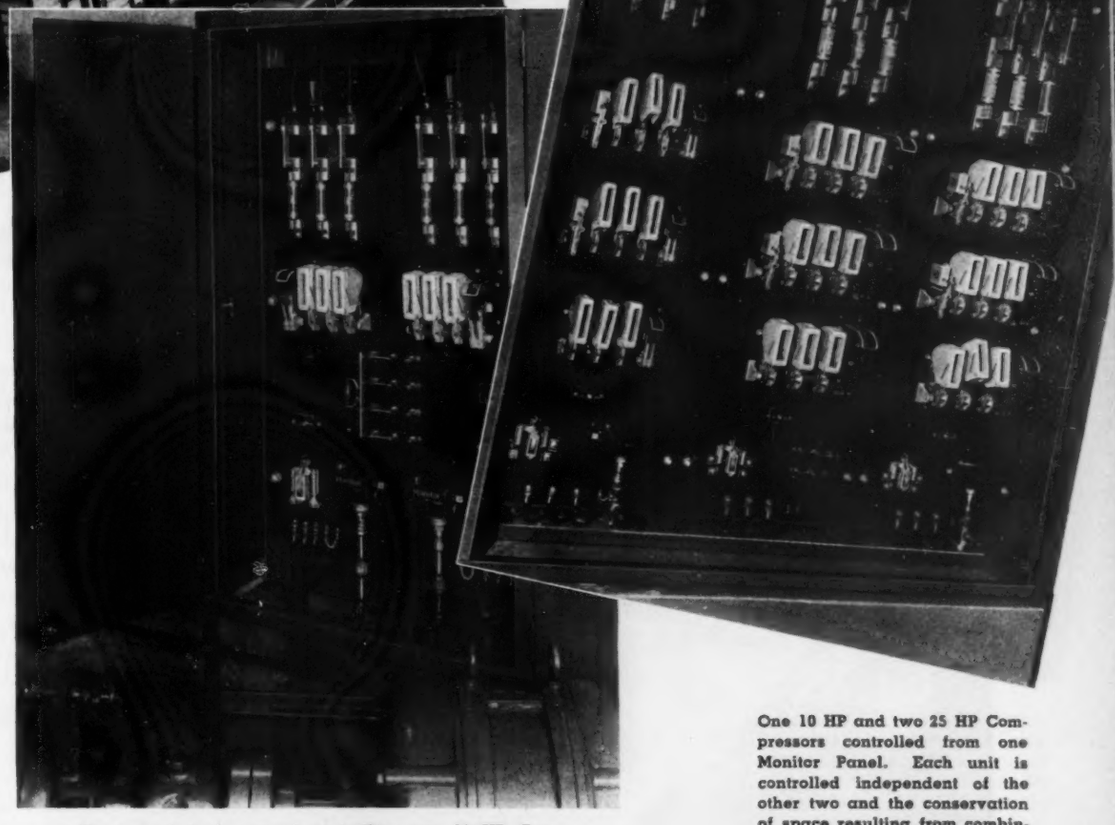


" . . . our Monitor Controllers have been working perfectly" ★

The Ultimate in Praise

★ "I just thought you ought to know that our Monitor Controllers downstairs have been working perfectly. They haven't given us a bit of trouble and I feel that you should know it, and please don't hesitate to use my name as a reference at any time."

HOTEL ROCHESTER
Will M. Steenman, General Manager



Monitor
BALTIMORE, MD.
The Original
"JUST PRESS A BUTTON" System

ery Good Installation
eserves Monitor Control

Closeup of duplex panel controlling two 10 HP Compressors. Arranged to use either compressor while other is shut down.

One 10 HP and two 25 HP Compressors controlled from one Monitor Panel. Each unit is controlled independent of the other two and the conservation of space resulting from combining three in one is considerable.

heMonitorControllerCompany

LOMBARD & FREDERICK STS. BALTIMORE, MARYLAND

LOAD BUILDING

Ultraviolet Decorates California Theatre

Utility salesmen approached by prospects who want ideas and specifications for something new and different in lighting will be interested in the way invisible ultraviolet radiations have been put to work to produce interesting and effective decorative lighting effects in the new Tower Theater at Roseville, Calif., near Sacramento, on the lines of Pacific Gas & Electric Company.

Eight Westinghouse ultraviolet lamps—six of the BH-4 "black light" type and two CH-4 mercury spotlight lamps behind purple glass filters—are used to activate fluorescent pigments in wall, ceiling and proscenium designs. When house lights are turned off scrolls and paintings glow with soft pink and green visible light produced by the action of invisible ultraviolet radiations on the fluorescent paints.

Four ultraviolet lamps are located on the rim of an 800-lb. central indirect lighting fixture in the theater. Two are of the BH-4 type in polished aluminum reflectors and two of the CH-4 spot type behind purple glass filters. Fluorescent designs on the ceilings are activated by four BH-4 lamps in polished aluminum reflectors and two of the CH-4 spot type behind purple glass filters. Fluorescent designs on the ceilings are activated by four BH-4 lamps in polished aluminum reflectors, concealed in pockets over two exit doors on each side of the theater.

Total load of the central fixture, exclusive of ultraviolet sources, is 10 kw. Mounting height is 35 ft., the average height of the ceiling. Incandescent lamps in the central fixture are red, white and blue, controllable on separate circuits. Seating capacity of the theater is approximately 1,000 persons.

ULTRAVIOLET and 10 kw. of incandescent are employed in central fixtures of small theatre to give owner "something new" and to provide utility revenue

Modern Lighting Leads to Extra-Pure Milk

Electricity on the farm reaches a new high at Broadacres, Lebanon, N. J., provides proof of its efficacy in contributing to super-pure milk and as evidence of the practicability of the installation other dairies in Hunterdon County intend to follow suit.

Three types of lamps are used in the dairy, fluorescent, germicidal and sunlamps. Nine of the sunlamps, mounted on 6-ft. centers and shown in the accompanying illustration are used to prevent ultra-violet deficiencies in the herd. The cows are given two two-hour sun baths per day, according to J. F. O'Brien, owner, not to build up their vitamin D-1, but to hold onto supply already built up and stored by the cow, to keep them up to par.

Sunlamps are turned on from 5-7 a.m. and 6-8 p.m. and are so installed and mounted (8 ft. from floor) that each cow is irradiated by overlapping light from two lamps. Another bin for small stock has two lamps, the output being measured by ultra-violet meters to control actinic ray content. A delivery bin is fitted with two sunlamps.

Striking results in supplying pure milk from this prize herd are secured by protecting the milk in process with a zone of protection through germicidal lamps.

Grade A Pasteurized milk allows for 30,000 bacteria count per c.c.,

Certified
FLEUR-O-LIER
The Manufacturer guarantees by affixing this label that
Fluorescent Luminaire is a duplicate of samples found
periodic examination to comply with the minimum
ments as set up in the
"SPECIFICATIONS FOR LUMINAIRE
FITTINGS AND AUXILIARIES
FOR FLUORESCENT LAMPS"
which are sponsored by the Manufacturers of Mazda
ELECTRICAL TESTING LABORATORI
NEW YORK, N. Y.
E·T·L
A COPY OF THIS CERTIFICATE SHOULD
APPEAR UPON EACH UNIT OR PACKAGE
FLUORESCENT LIGHTING FIXTURES EMPLOYING
TYPES OF LAMPS ARE NOT RECOMMENDED FOR SCHOOL
SIMILAR LOCATIONS UNLESS LAMPS ARE SHIELDED FRO
THIS CERTIFICATION IS CONTINGENT UPON
OF CERTIFIED AUXILIARIES OF OVER 85%
LOOK behind the
FLEUR-O-LIER
LABEL
See why you get dependability
in FLUORESCENT lighting fixtures
that wear it!

Famous Electrical Testing Laboratories put FLEUR-O-LIER fixtures through exhaustive tests, which include such vital points as FLICKER CORRECTION, DURABILITY AND SAFETY, EASE OF MAINTENANCE, DEPENDABLE BALLASTS AND STARTERS, EFFICIENT LIGHTING PERFORMANCE, HIGH POWER FACTOR (85% OR OVER).

Based on these tests, Electrical Testing Laboratories gives the FLEUR-O-LIER manufacturer the right to affix the label of certification to all fixtures identical to the sample submitted. This label is your assurance that the fixture wearing it meets the 50 rigid specifications set up by MAZDA lamp manufacturers for better light, better service. You can buy Certified FLEUR-O-LIERS with confidence!

Certified FLEUR-O-LIERS are guaranteed by their manufacturers to be free from any defects in materials, workmanship or assembly for a period of 90 days. Note the complete guarantee with which every FLEUR-O-LIER Manufacturer complies.

IMPORTANT!

Before you buy fluorescent lighting, check with your local electric service company. They will be glad to give you expert advice on how to install fluorescent fitted to your specific needs.

WIDE VARIETY! ***You can now get Certified FLEUR-O-LIERS in over 100 different designs and in a wide range of prices. Ask your electrical supplier.***

FLEUR-O-LIER
Manufacturers

Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER requirements

TEAR OUT AND MAIL

Fleur-O-Lier Manufacturers • 2126-B Keith Bldg., Cleveland, Ohio

Please send me FREE new booklet "50 Standards for Satisfaction," together with list of Fleur-O-Lier manufacturers.

Name

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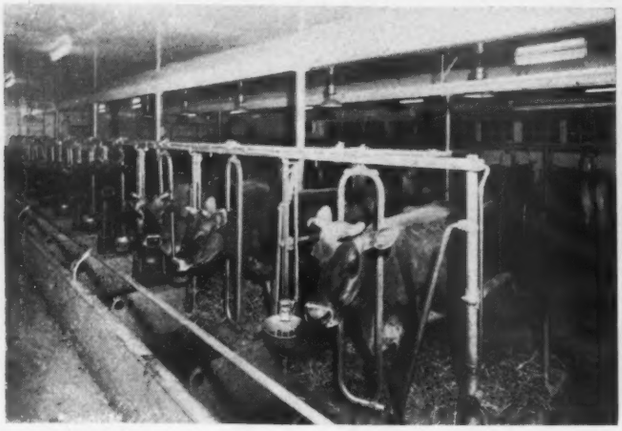
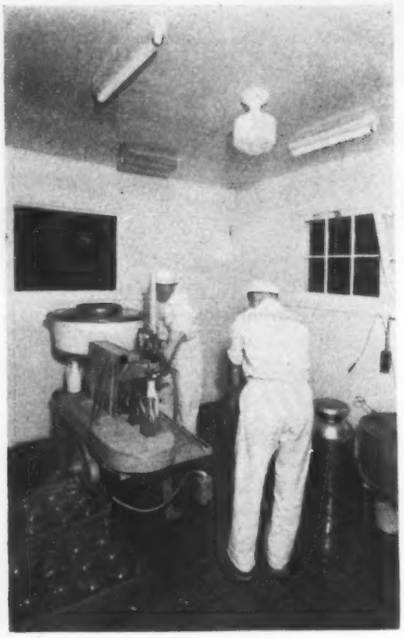
City State





PRIZE HERD of Jerseys at cow barn of Broadacres Farm, Lebanon, N. J., utilizes air conditioning, fluorescent for general illumination and S4 sunlamps for each animal (night view shown), above left.

THREE germicidal lamps are used to protect the milk in the utensil sterilizing room, one 15-watt over each door and the third unit is over the storage wet box (above, right).

VASTLY improved milk is secured by protecting entire milking process with germicidal lamps, such as shown here over the bottling machine. Another germicidal is mounted in hood over empty bottles entering bottling machine (at left).

Grade B 100,000 per c.c., but by the use of germicidal lamps this "raw" milk shows a bacteria count of less than 1,000 per c.c.

From the time the milk leaves the cow via milking machines until it is bottled it is protected by germicidal lamps whenever it is exposed.

In the weighing room a 15-watt germicidal lamp is located over the aerator, another over the strainer. In the utensil sterilizing room a 15-watt germicidal is placed over entrance and over exit and another over the wet box. A 4-watt lamp is used here as a can sterilizer.

In the bottling room fluorescents are used for illumination and the germicidal lamp is mounted over the bottling machine. Another is in the machine itself protecting incoming bottles and a third is located over the can racks.

Thus a fine herd of Jerseys combined with three types of lighting and "lighting for protection" all the way from cow to milk bottle results in a raw milk with a bacteria count far below that allowed for Grade A Pasteurized.

•

Feed Mixers Provide Desirable Loads

Recent developments in large-scale feeding of poultry and live stock along advanced dietary lines have brought the modern power-driven feed mixer to the front as a desirable load for rural lines. Typical mixers have a capacity range of 250 to 4,000 lb., with motor drives rated from ½ hp. to 7.5 hp.

The variation in motor ratings given in the accompanying table is due to differences in the type of ingredient mixed. For mixers using average ground feed, such as poultry mash and dairy mash, the lower motor ratings work out well, but if a considerable quantity of heavy mineral hog feed or heavy cracked grain and scratch grain is to be mixed, then the larger motors are required.

An example of work done by a 700-lb. Brower Manufacturing Company mixer (Quincy, Ill.) is of interest from the load-building viewpoint. Here a typical operation requires seven minutes for loading, ten minutes for mixing the feed and seven minutes for unloading, or 24 minutes total per batch. Two mixes of ordinary poultry mash and dairy feed aggregating 1,400 lb. can readily be run through a unit of this size in an hour, giving an average energy consumption of 750 watt-hr. or 1,870 lb. per kw.-hr. At a 4-cent rate this means a power cost for mixing of only 3 cents for 1,400 lb. of feed. Compared with mixing by hand, the labor saving is obviously striking in addition. The thoroughness of mix obtained is of great importance to the farmer, since power-driven mixers insure that every mouthful of feed eaten by the dairy cow, hog or chicken will be the same, thus contributing to maximum results, whether in egg, milk or pork production.

A typical dairy farm application showed returns of 50 to 75 cents per cow greater per month after mixing his feed mechanically as compared with the hand-and-shovel method. The milk flow was sufficiently improved to give this extra income per cow, averaging $72 per year for ten cows total. This saving represents one-half the list price of a 700-lb. mixer with a 1-hp. motor, or enough to pay for the unit in two years.

Typical Mixer Ratings

Capacity in Lb.	Motor Hp.	Capacity in lb.	Motor Hp.
250	½	2,000	3 to 5
700	1 and 2	3,000	5 to 7½
1,000	3 to 5	4,000	5 to 7½

IF YOU BUY, install or use paper insulated cables, our revised Data Sheet #109 will interest you.

Simplex Wire & Cable Co.
Factory and Main Office
79 Sidney St., Cambridge, Mass.

Chicago New York Detroit Cleveland
Philadelphia Atlanta San Francisco

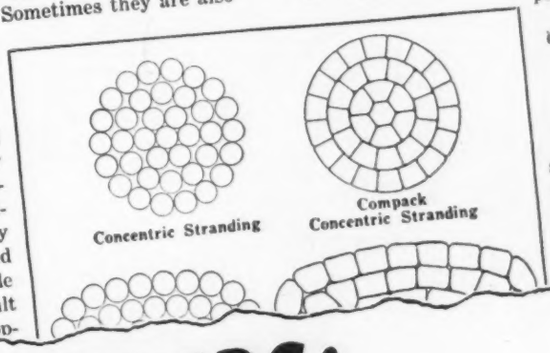
JUNE, 1941
Replacing June, 1936

Data Sheet 109
Simplex Impregnated
Paper Insulation
for Power Transmission Cables

SIMPLEX IMPREGNATED PAPER INSULATION

Paper insulated power cables are generally accepted as the most economical type of cable for the transmission and distribution of large blocks of power at higher voltages. Sometimes they are also used for the interconnection of apparatus in central stations, sub-stations and industrial plants. They must be protected by a lead sheath or other watertight seal because of their low resistance to moisture. They are more easily damaged than other types of cable and are more difficult to joint and install prop-

a. Round conductor – compack or non-compack.
b. Sector conductor for three or four conductor cable – compack or non-compack.
c. Segmental conductor – compack or non-compack.
d. Annular conductor – non-compack around a fibrous core.



The use of compack stranding results in a saving of 3% to 5% in overall diameter. In addition, compack strand produces technical improvement such as higher

IT COVERS:

Conductors
Paper Insulation
Paper Grading
Paper Taping
Impregnating Compound
Shielding
Vacuum Drying
Gas Washing
Impregnating
Lead Sheaths

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.

SIMPLEX WIRES CABLES

NEW EQUIPMENT

Electroplating Equipment

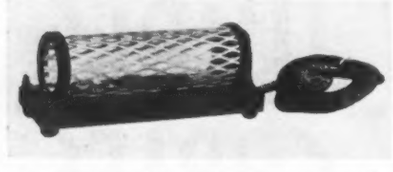
New copper oxide rectifier and a separate hand-operated "on-load" voltage regulator permit adjustment during operation without interrupting current flow in electroplating tank. One can control a number of parallel rectifier units. Over-all full-load efficiency is said to be approximately 70 percent to about half-load and falls off slightly at 25 percent load. Power factor is claimed to be 90 percent or better over the normal operating range.

Fan-cooled copper oxide rectifier; size, 500 amp.; d.c. voltage ratings, 6 and 12 volts; operates from 230 or 440-volt, three-phase, 60-cycle circuits. **General Electric Co.**, Bridgeport, Conn.

•

Soldering Iron Stand

New automatic electric soldering iron stand can be set to maintain an iron, in the device, at a predetermined temperature and have it ready for immediate use with bright tin on the tip. Desired idle temperature is obtained by means of an adjusting screw on the bottom of the stand. Cast-iron frame has a protective cage. Soldering iron is plugged into the female end of a series plug connected in a 6-ft. cord.



Automatic electric soldering iron stand; while for general use the stand is supplied only for a.c., it can be supplied for use on d.c. **Vulcan Electric Co.**, Lynn, Mass.

•

Fluorescent Unit

"MF-240-N" fluorescent canopy; takes two 40-watt lamps; 110-120 volts, 60 cycles. **The Fostoria Pressed Steel Corp.**, Fostoria, Ohio.

Through the use of a "power unit," this fluorescent lighting fixture features instantaneous starting response without the use of starting switches. High power factor is a stated feature of the canopy unit, which is also said to be free from flicker, hum and radio interference. Bracket is adjustable for directional lighting.

•

Instrument Charts

"I-EZ Permocharts" for recording instruments using circular charts. **Permochart Co.**, Sewickley, Pa.

Charts made of Vinylite plastic are now available in three colors—green, ivory and blue—to reduce glare and eyestrain to a minimum, it is claimed. They can also be used to identify different units or operations. Like the white plastic charts, the colored charts are made for continued reuse; ink record can be removed with a damp cloth.

•

Snap Switch

"AcroSnap" switches; standard model ratings: 10 amp., 115 volts a.c.; 5 amp., 250 volts a.c.; 3 amp., 450 volts a.c.; operates on pressures from 1/2 to 14 oz. **Acro Electric Co.**, Cleveland, Ohio.

One-piece blade and rolling spring are used in this snap switch to provide frictionless snap action, according to the makers. Unit makes use of fine silver contacts. It is single-pole and furnished with normally open, normally closed or double-throw contact arrangements.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Multi-Breaker

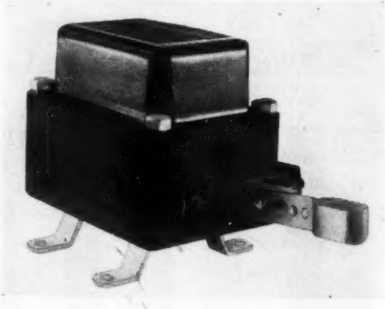
Disconnecting and protective device for normal-duty applications, this multi-breaker is furnished with dust-resisting inclosure having ten concentric knockouts. Bimetal thermal element trips breaker on short circuit or dangerous overload, but its inverse-time characteristic allows the breaker to remain closed during temporary harmless overloads. An indicating target on the inclosure cover shows when multi-breaker has tripped.

Types "M-1" and "M-2" multi-breaker; capacities 15 to 200 amp., two or three poles, 230 volts a.c. **Westinghouse Elec. & Mfg. Co.**, East Pittsburgh, Pa.

•

Float Switches

Water-tight float switch has an inclosure of a heavy cast-iron cover and base. A



Type "9048AW" watertight float switch; 110 to 550 volts a.c. or d.c. **Square D Company**, Detroit, Mich.

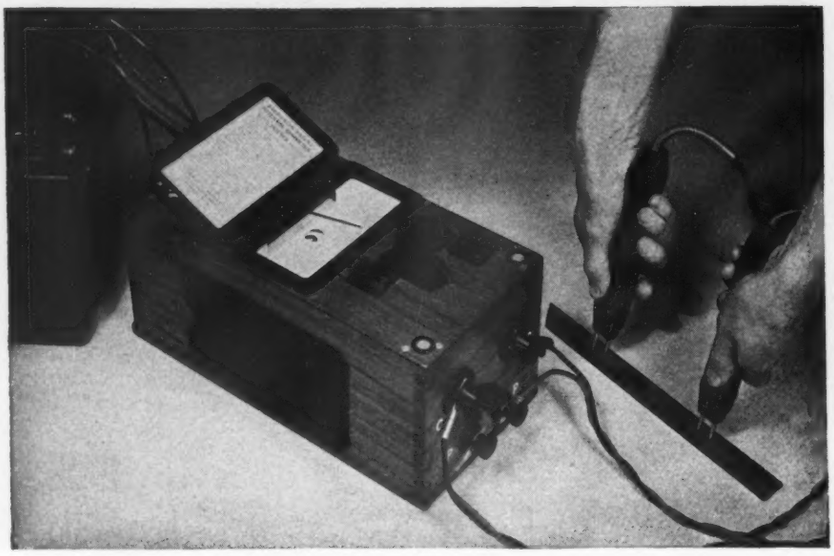
THE BEST OFFENSE IS A GOOD DEFENSE

The heart of any defense program lies in production, adequate stocking and distribution. If any one of these three is lacking the front line must eventually fail. Hubbard and Company has *all three* perfected to the highest degree humanly possible. Three huge factories deliver a constant stream of galvanized Hubbard Pole Line Hardware to swell a 6000 ton reservoir of stock for emergency deliveries. A nation-wide distributing system draws on this reserve to maintain smaller units of stock in all the principal cities.

Hubbard and Company is proud of the privilege of teaming with its distributors to provide smooth flowing manufacturing and "pre-promise" deliveries so that together, they may keep the supply lines of power humming for defense construction.

HUBBARD AND COMPANY

PITTSBURGH . . . CHICAGO OAKLAND . . . CALIFORNIA



Get the "Low-down" on Circuit Breaker Performance

"DUCTER" LOW RESISTANCE OHMMETER

measures current-carrying ability of circuit breakers and switches down to .000001 ohm

Built to "stand the gaff" of field use . . . reads directly by pointer deflection . . . so accurate and reliable that your laboratory can readily give O. K. . . . SUCH is the Ducter Ohmmeter, a rugged "Megger" type instrument that is now finding important uses in circuit breaker maintenance and for testing other low resistances that today *must* carry their rated loads.

The Ducter operates from a storage battery, and by applying test leads, one can actually *see at a glance* the condition of a vital part of a circuit breaker, switch or joint—namely—its contact resistance. The Ducter Ohmmeter does for measuring conductor resistance what "Megger" Instruments do for testing insulation resistance.

Write for illustrated descriptive Bulletin 1635-W.

"MEGGER"

TRADE MARK REGISTERED U. S. PAT. OFF.

James G. Biddle Co.

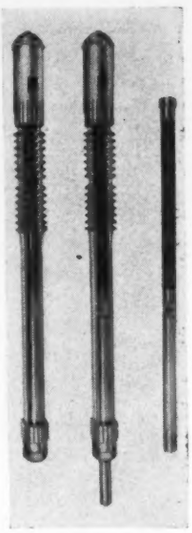
1211-13 ARCH STREET *Electrical and Scientific Instruments* PHILADELPHIA, PA.

rubber gasket is provided to make it watertight. Explosion-resisting type is identical to the watertight type, but the surfaces between the cast-iron cover and base are machined to comply with Class I, Group D hazardous location requirements. Entries to the switch chamber are through approved openings by means of closely fitted steel shafts.

•

Fuse

Expanding its range of fuse equipment, the company announces that this design for high-voltage service combines features of the type COR liquid fuse and type SM solid material fuse. A field-replaceable fusible element assembly is housed in a Pyrex glass tube corrugated at the upper end, and a condenser at the vent for confining the gas discharge. A long gap for arc interruption can be produced between terminals of the fusible section, it is claimed.

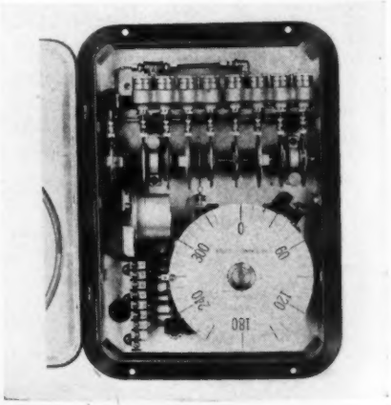


Type "SMG" power fuse; short-circuit interrupting ratings range from 9,000 amp. r.m.s. for 46-kv. fuse to 5,000 amp. for 132-kv. fuse. Left—Fuse holder with refill unit in place. Center—indicating blown fuse; internal sleeve projects below holder. Right—Replaceable refill unit. **Schweitzer & Conrad, Inc.,** 4435 Ravenswood Ave., Chicago, Ill.

•

Time Cycle Controller

Multiple-cam time cycle controller is designed for timing mechanical operations in industrial processes. Time measurement and pilot valve operation are handled by separate mechanisms. Timing is accomplished by a Telechron-driven aluminum disk on which is printed a 25-in. time scale. Desired schedule of operations is incorporated into the controller by punching holes with an ordinary ticket punch on the time scale. Cams are individually adjustable.



Model "A-118" impulse-sequence cycle controller; drilled for eight cams and pilot valves. **The Bristol Company,** Waterbury, Conn.

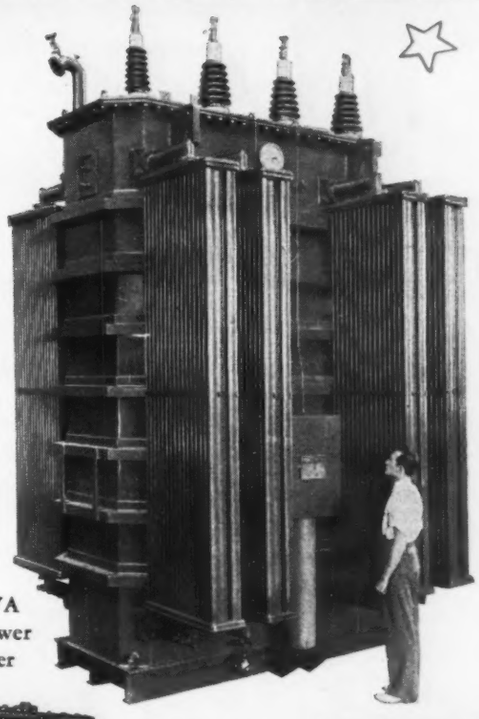
Day and Night... WAGNER TRANSFORMERS ARE FURNISHING DEPENDABLE POWER TO HELP SPEED *our* NATIONAL DEFENSE PROGRAM

IN DEFENSE INDUSTRIES . . . power plants . . . air ports . . . government construction work — wherever the use of dependable electric power is an important factor, you will find Wagner transformers doing their part in speeding up our national defense program.

Wagner transformers, through 50 years of service to industry, have proved their ability to furnish unfailing power, and it is only natural that they should be selected for the key points of power distribution in this time of national emergency.

Wagner builds all types and sizes of power and distribution transformers including stud-bushing type; primary-pocket-stud type; sub-station and sub-way types; single or three phase; rural line; air cooled; Noflamol; and Type YH Constant-Current Regulator.

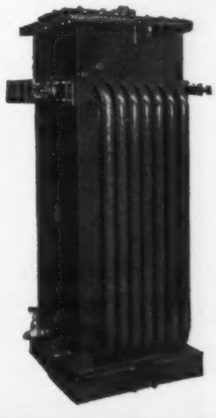
Because of large plant capacity, vast manufacturing facilities, and 50 years of engineering and manufacturing experience, Wagner can give immediate attention to all your transformer requirements.



10,000-KVA Wagner Power Transformer

Send for Complete Literature

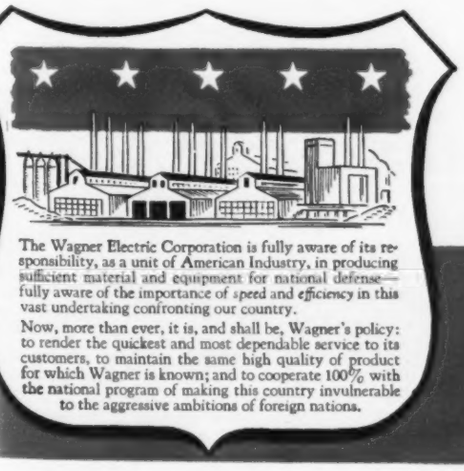
For complete descriptive literature on the design and construction of Wagner transformers write for bulletins TU-180 (distribution) and TU-181 (power).



150-KVA Wagner Noflamol Transformer

75-KVA Wagner HEX Transformer

T41-13



The Wagner Electric Corporation is fully aware of its responsibility, as a unit of American Industry, in producing sufficient material and equipment for national defense—fully aware of the importance of speed and efficiency in this vast undertaking confronting our country.

Now, more than ever, it is, and shall be, Wagner's policy: to render the quickest and most dependable service to its customers, to maintain the same high quality of product for which Wagner is known; and to cooperate 100% with the national program of making this country invulnerable to the aggressive ambitions of foreign nations.

Wagner Electric Corporation

6400 Plymouth Avenue, Saint Louis, Mo., U.S.A.

TRANSFORMERS • MOTORS • FANS • BRAKES

HOW TO BEND 1¼-4½ in. PIPE 3 TIMES FASTER

If you bend conduit and pipe with obsolete bending equipment or clumsy makeshift methods, Greenlee Hydraulic Benders can save you as much as 75% in bending time. Greenlee Benders, with their powerful hydraulic units, bend 3 times faster because they're easier for the man on the job to operate. The No. 770 Bender, shown above, has a maximum pressure of 25 tons for bending 1¼ to 3-inch conduit, while the larger No. 775 Bender with a maximum pressure of 40 tons will handle 3 to 4½-inch material. There's also a complete selection of Greenlee hand benders for tubing up to ¾-inch. Write for new S-116 Bender Booklet . . . it'll show you how to save time and money on every bending job.

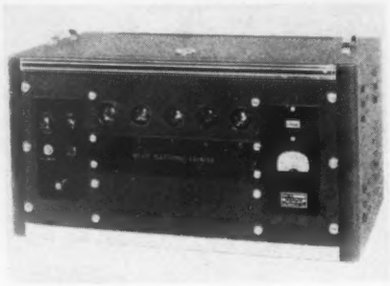
★ HERE'S WHY YOU SAVE TIME WITH GREENLEE BENDERS

- ✓ One man can easily and quickly develop the pressure needed to bend conduit up to 4½ inches.
- ✓ You save cost and time of installing many manufactured bends and fittings.
- ✓ You eliminate expense and delay of cutting and threading nipples.
- ✓ The smooth, even bends made by Greenlee, eliminate wasted time when pulling in wire.
- ✓ The Greenlee, built in one unit, is easily carried to the job and set up and is easier for operator to handle.

GREENLEE TOOL CO.
1705 Columbia Ave., Rockford, Illinois

Electronic Counter

New high-speed counting device provides a range from zero to 2,000 counts per minute. Counter input circuit—two conductors



Electronic counter; operates on 110 volts. **Shallcross Mfg. Co.**, Collingdale, Pa.

—is connected to single-pole, single-throw switch actuated by moving objects to be counted. For standard counting jobs a group of five gas triodes is used, numbered 1, 2, 3, 4 and 0. Each count is picked up by a triode in this order; every time No. 0 is fired the registering device is moved up another unit, and then the cycle is repeated. While a "scale of 5" is standard, scales of 10 or 15 and other scales are obtainable.

•

Electric Brazer

"Ideal No. 60" electric brazer; operates on 230-volts, 50-60 cycles; 440-volt and 25-cycle units also available; rating is 7½ kva. **Ideal Commutator Dresser Co.**, Sycamore, Ill.

For brazing and soldering with silver solder, this new unit consists of a power transformer that changes supply voltage to 10 volts, and a pair of electric heating pliers. Holding part to be brazed in the pliers closes the secondary circuit, causing the part to heat to brazing temperature. Heat is controlled by an on-off footswitch.

•

Ground Fitting

Solderless fitting for rigid conduit uses No. 4 B&S gauge extra flexible copper

"GF22" solderless fitting for rigid conduit; ½-in. size conduit; ½, ¾ and 1-in. pipe size. **H. B. Sherman Mfg. Co.**, Battle Creek, Mich.

braided strap between conduit end and pipe clamp. Pipe clamp can be detached and used separately.

•

Fluorescent Unit

"Silverline;" wattages, 5-ft. section with one lamp ballast, 124 watts; 10-ft., two-section unit with two-lamp ballast, 235 watts. **Curtis Lighting, Inc.**, Chicago, Ill.

Designed for use with 5-ft., 100-watt fluorescent lamp, this fluorescent ceiling light is available with a nine-fin louver as an accessory. Individual sections couple together to make up continuous runs; feeder lines can be carried from one unit to another through the wiring channel. Unit is made of steel with baked aluminum finish.

•

Glass Surface Troffer

"G-S-T" glass surface troffers for one or two rows of fluorescent lamps. **Edwin F. Guth Co.**, St. Louis, Mo.

Totally inclosed fluorescent luminaires have reflectors of a "V" design between lamps and a modified "V" between lamps so that "pocketed" light is minimized, it is claimed. Inclosing glass can be removed without use of tools or tension. Reflectors are also removable. Units are available in base or extension sections for individual and continuous mountings.

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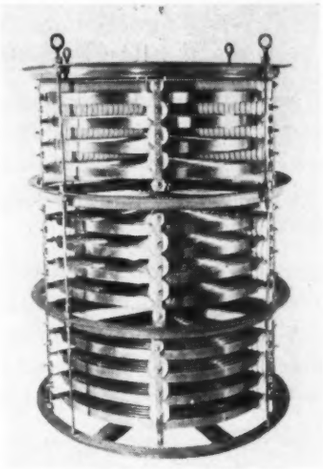
Immersion Heaters

Electric immersion type booster heaters are offered for maintaining and increasing temperatures of a wide range of materials. Consisting of spirally coiled heater strips



"Falcon" electric immersion type booster heaters; in capacities from 10 kw. to 1,000 kw. output. **H. O. Swoboda, Inc.**, New Brighton, Pa.

arranged to form a compact unit, heater is installed in sealed tank built in pipe line between storage vessel and coating or saturating tank. Temperature is maintained uniformly by means of automatic controls, either thermostat or pyrometer with thermocouple. Heater is applicable for use with any non-conductive materials. In operation, "bare" electric coils are immersed in material to be heated, establishing a direct thermal contact.

•

Rectifiers

Dry plate rectifiers for electroplating; capacities 300 and 500 amp. at 6 and 12 volts, operating from 230 and 440 volts, three-phase, 60-cycle circuits. **Benwood Linze Co.**, St. Louis, Mo.

Added to the company's line of rectifiers and rectifier equipment are dry plate rectifiers for electroplating. These rectifiers assembled in cabinets will serve individual tanks, or a number of units may be grouped together in parallel to meet the demands for heavy current loads, or the units may be grouped in series for maximum high voltage requirements. Control units are also available which provide a variation in voltage from the maximum for the unit down to zero volts.

HERE'S THE *Proven & Guaranteed* FLUORESCENT LIGHTING SYSTEM

That's 30% to 50% cheaper to install!

That provides 50 Foot Candles or better!

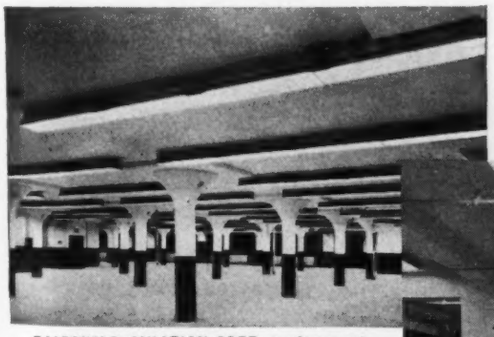
That's easier, cheaper to maintain!

IVANHOE
"50 FOOT CANDLER"
RLM *Continuous Wireway*
FLUORESCENT LIGHTING SYSTEM

● Two years ago IVANHOE "50 FOOT CANDLER" was introduced as the first RLM Continuous Wireway Fluorescent Lighting System providing new higher levels of overhead illumination. Now its merits have been *proven* in such outstanding organizations as Fairchild Aviation Corp., Uxbridge Worsted Co., Combustion Engineering Co., General Electric Co., Curtiss-Wright Corp., and many others. Hundreds of miles of "50 FOOT CANDLERS" are today giving satisfaction in key Defense plants, industry and business.

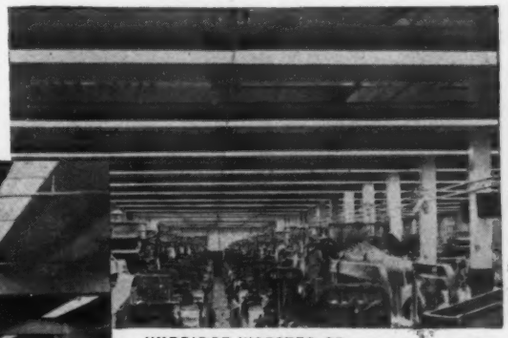
"50 FOOT CANDLER'S" continuous wiring channel (containing all necessary auxiliaries and up to 80 per cent of conduit) means installation savings of 30 to 50 per cent. Speedy installation, too—with no slow-up of production while lighting is going in. Easy-to-remove, porcelain-enameled reflectors lick maintenance headaches.

These *proven* features of IVANHOE "50 FOOT CANDLER" now make it possible for many of your customers to get the greater benefits of higher illumination. *Further details in Bulletin 1-C.*



FAIRCHILD AVIATION CORP. employees get 50-55 foot candles of light for fine inspection and assembly jobs with "50 FOOT CANDLER" in this new plant addition.

COMBUSTION ENGINEERING CO. use their new "50 FOOT CANDLER" lighting system to give draftsmen 60-65 foot candles of unmatched working light.



UXBRIDGE WORSTED CO. use many rows of "50 FOOT CANDLERS" in their weave rooms. Here workers have the production aid of 58 foot candles of well-diffused illumination.

• • •

MILLER OFFERS A COMPLETE LINE of incandescent and fluorescent lighting equipment, backed by almost 100 years of commercial and industrial lighting specialization. There is an answer to *your* problems in this *unbiased* lighting service.

IVANHOE FLUORESCENT RLM

THE MILLER COMPANY
MERIDEN, CONN.
Pioneers in Good Lighting Since 1844

NEWS ABOUT PEOPLE

N. E. P. Service Announces Election of Officers

President Carl S. Herrmann of the New England Power Association has announced the election of new officers for the New England Power Service Co., Boston, headed by Thomas G. Dignan as president.

The vice-presidents are Leeds A. Wheeler, a legal member of the system since 1934; Edwin A. Dow, for 22 years with the system and lately chief engineer; Robert H. Jameson, former manager of the Marlboro (Mass.) Electric Light Co., and Herbert W. Greenhalgh, for the past few years general auditor of the Service Company. The set-up also includes Harold L. Dalbeck, treasurer; Lewis J. Catheron, assistant treasurer; Elmer H. Lother, auditor; David J. Donahue, clerk and secretary, and John E. Teagan, assistant secretary. C. Joseph Walker and Francis J. Buckley are assistant vice-presidents.

President Herrmann announced that the election of new Service company officers is a part of the plan for reorganization of its methods of doing business under Sec. 13 of the Public Utility Holding Company Act of 1935.

R. H. Jameson

E. A. Dow

L. A. Wheeler

H. W. Greenhalgh

•

▶ T. R. Rhea has been appointed engineer of the chemical section, a new division in General Electric's industrial engineering department, according to an announcement by J. D. Wright, manager of the department. A graduate of the Massachusetts Institute of Technology in 1924 with the degree of bachelor of science in electrical engineering, Mr. Rhea entered the employ of General Electric that year as a student in the test course. In 1930 he joined the industrial engineering department. Mr. Rhea is the holder of several patents, most of them concerned with the application of electrical equipment to steel mills.

▶ L. N. Robinson, consulting engineer, has been appointed assistant engineer of the Puget Sound Power & Light Co., Seattle, Wash. From 1916 to 1919 Mr. Robinson was a member of the electrical engineering department at the University of California, Berkeley, and from 1919 to 1931 was associated with the Stone & Webster organization. He went into the consulting engineering field in Corning, N. Y., in 1933. Mr. Robinson is a fellow of the American Institute of Electrical Engineers.

▶ Harry C. Rankin, laboratory engineer New England Power Service Co., Providence, R. I., has been elected vice-president of the Providence Engineering Society.

▶ E. A. Evens has been elected treasurer-comptroller of the Eureka Vacuum Cleaner Co. Mr. Evens was for several years vice-president and treasurer of the American Gas Machine Co.

▶ Ralph G. Raymond has been appointed assistant manager, lighting sales, Commonwealth Edison Co., Chicago. He succeeds John C. O'Brien who recently retired. Before identifying himself with the Commonwealth Edison Co. in 1938 he was connected with the Chicago Lighting Institute.

▶ A. Ray Cumming has been appointed commercial cooking engineer for the United Illuminating Co., New Haven, Conn., and will cover both the New Haven and Bridgeport areas for that utility. For the past seven years Mr. Cumming has been in similar work with the Public Service Co. of New Hampshire, with headquarters at Manchester; prior to then he was for twelve years head of the Cumming Electric Co., electrical contractors, at Houlton, Me., and earlier was with the Houlton Water Co. in the electrical department.

▶ J. B. Noe, assistant to the planning engineer of the Consolidated Edison Co. of New York, Inc., New York, retired recently after 43 years with the company. From 1897 to 1901 he was employed as a meter tester by the Edison Electric Illuminating Co., now the Consolidated Edison Co. of New York, and

ORANGEBURG HAS BEEN A LASTING NAME "UNDERGROUND" FOR 48 LONG YEARS

Buried in salt marshy ground below tide-water . . . in corrosive cinder and refuse backfill . . .

ORANGEBURG CONDUITS

are contributing to an uninterrupted flow of power from central stations to the motors of industry

ORANGEBURG *Standard* for installation *with* concrete encasement
NOCRETE for installation *without* concrete encasement

Photograph by Galloway

Build for tomorrow with

ORANGEBURG *Conduits*

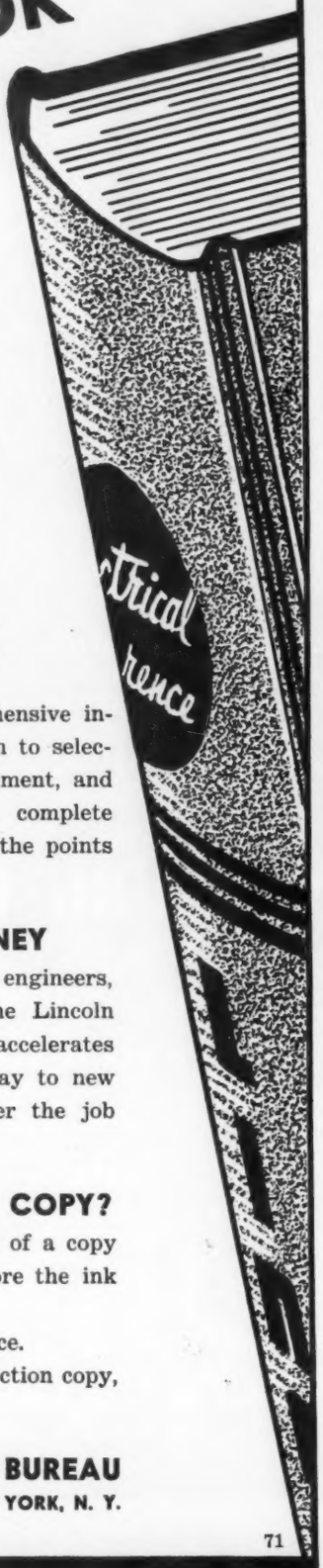
MADE AT ORANGEBURG, NEW YORK, BY THE FIBRE CONDUIT COMPANY, 292 MADISON AVENUE, NEW YORK CITY

Sales Agent—Distributors

GRAYBAR ELECTRIC CO., INC. GENERAL ELECTRIC SUPPLY CORP.

8-SC-2

THE BIG BOOK *is on press!*



By any measuring stick, Lincoln's Electrical Reference is the biggest book ever attempted in the electrical field. It was compiled at the request of leaders in all branches of the electrical industry.

It is 8½ by 11 and nearly 4 inches thick. It has 1200 pages, 1200 illustrations, 326 diagrams and 315 tables and more than half a million words all devoted to practical electrical engineering. While it took four years to produce it, it takes only a minute to find the facts on any specific problem.

Divided into 26 sections with comprehensive indexes, it treats every phase from design to selection of industrial and commercial equipment, and installation to maintenance, with the complete National Electrical Code reproduced at the points where it will be used.

SAVES TIME—SAVES MONEY

Industrial plants, power companies, engineers, designers and contractors will find the Lincoln Electrical Reference indispensable. It accelerates planning and installation, shows the way to new economies and prevents difficulties after the job is installed.

WOULD YOU LIKE TO SEE A COPY?

Without obligation—you can be assured of a copy on your desk for inspection almost before the ink is dry.

The price $15 includes follow up service.

Write now on your letterhead for inspection copy, returnable collect without obligation.

ELECTRICAL MODERNIZATION BUREAU
ROOM 805 W • 60 EAST 42nd STREET • NEW YORK, N. Y.

71

Lincoln
ELECTRICAL REFERENCE

for a year was also electrical engineer of the Consolidated Telegraph & Electrical Subway Co. In 1902 he became assistant to the superintendent of transmission and distribution of the Consolidated Edison Co. and in 1910 he was made assistant to the chief electrical engineer. He became assistant engineer of the electrical engineering department in 1925. Mr. Noe is a fellow of the American Institute of Electrical Engineers and a member of the American Standards Association.

•

Copperweld Steel Names McIlvane Sales Manager

William J. McIlvane has been appointed general manager of sales of the copperweld division of the Copperweld Steel Co., Glassport, Pa.

Mr. McIlvane succeeds Robert J.

Frank, who resigned as vice-president in charge of sales on July 31. Mr. Frank will continue as vice-president and director of the company. Mr. McIlvane was formerly eastern district manager and later sales promotion manager for Copperweld.

•

▶ PAUL B. ZIMMERMAN has been appointed vice-president and general sales manager of the Airtemp division of the Chrysler Corp., Dayton, Ohio. Mr. Zimmerman was formerly vice-president and treasurer of Grace & Bement, Inc., national advertising agency with headquarters in Detroit, Airtemp's advertising and merchandising counsel. Mr. Zimmerman joined the advertising agency in 1939 as a partner, following his resignation as vice-president in charge of sales and assistant to the president of the Norge division of Borg-Warner Corp. He has had an unusually broad and varied experience in

the distribution and marketing of new products, having been a sales and advertising official of the General Electric Co. for more than 20 years prior to his connection with Borg Warner.

•

OBITUARY

Bancroft Gherardi

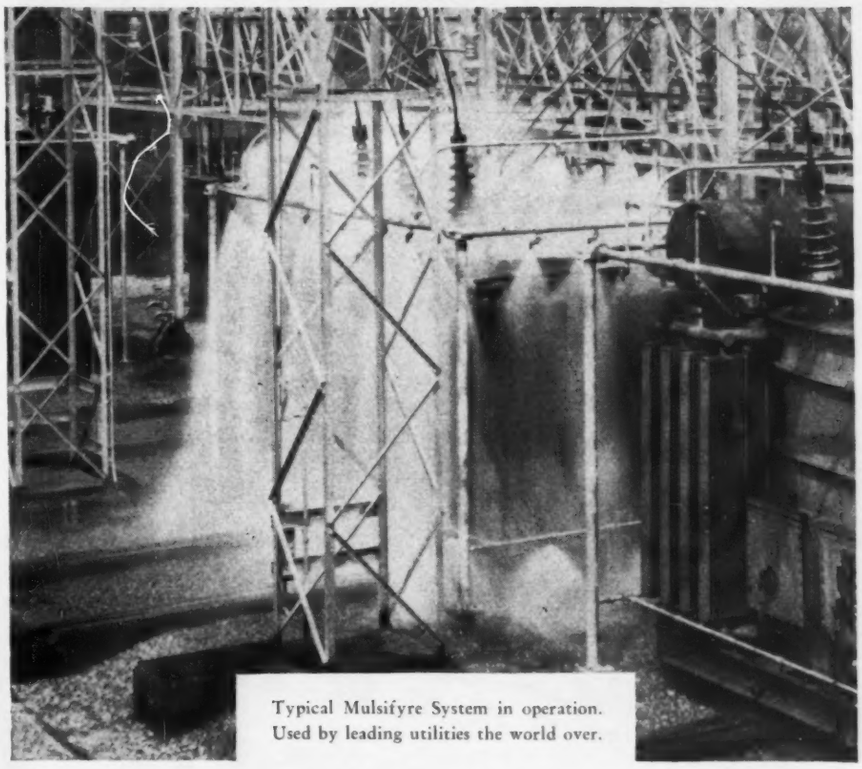
Bancroft Gherardi, formerly vice-president and chief engineer of the American Telephone & Telegraph Co. and past-president of the American Institute of Electrical Engineers, died, of a heart attack, on August 14 while on a vacation near Sudbury, Ont.

Mr. Gherardi, who retired in 1938, devoted his entire professional and business career to the art of communication. Born in San Francisco in 1873, the son of Rear Admiral Bancroft Gherardi, he was educated at various elementary schools, depending on where his father's assignments as a naval officer

took him, and received the B.Sc. degree from the Polytechnic Institute in Brooklyn. Two years later he took his M.E. degree from Cornell University and a year later his M.M.E.

Entering the communication field in 1895, when the telephone art was very young, he played a most important part in the development and perfection o operating practices and in the development of methods, equipment and apparatus which have brought telephone communication to its present high state of perfection. Starting with the Metropolitan Telephone & Telegraph Co., in 1900 he joined the New York Telephone Co. and the following year became chief engineer of the New York & New Jersey Telephone Co. When these two companies were consolidated in 1906 he was made assistant chief engineer of both. In 1907, when Theodore N. Vail became president of the A.T.&T., he

Changes Blazing Oil into Non-flammable Emulsion



Typical Mulsifyre System in operation. Used by leading utilities the world over.

Unique Mulsifyre System kills fire FAST with driving water spray!

There's no time for smoke or heat to cause major damage when a Mulsifyre System goes to work on oil fires. Within 2 to 5 seconds, this proved system has not only smothered the flames but made the oil itself temporarily "fireproof"!

Here's how it works. When fire starts in any Mulsifyre-equipped unit, high-pressure water is admitted to the system by either manual or automatic valves. Instantly, a driving spray of water from the patented Mulsifyre Nozzles strikes the oil . . . churns the surface into a non-flammable emulsion.

Get full information on this outstanding development in oil-fire protection. Write for detailed booklet. Grinnell Co., Inc., Executive Offices, Providence, R. I. Branch offices in principal cities.

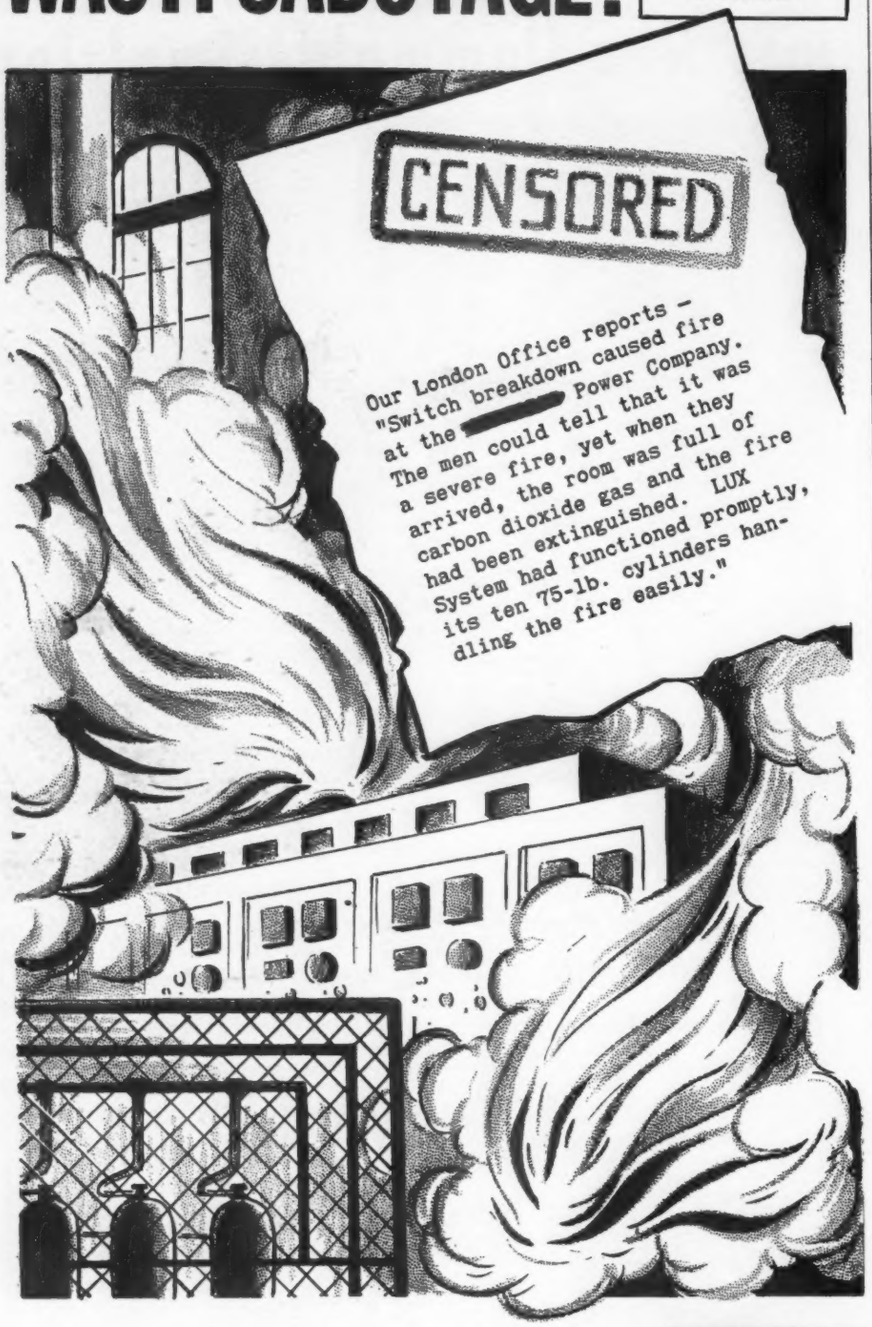
WRITE FOR *this 76-page booklet by Underwriters Laboratories explaining Mulsifyre Systems in detail.*

GRINNELL

Automatic Sprinkler Fire Protection

WAS IT SABOTAGE?

A REPORT FROM ENGLAND


CENSORED
Our London Office reports —
"Switch breakdown caused fire
at the [redacted] Power Company.
The men could tell that it was
a severe fire, yet when they
arrived, the room was full of
carbon dioxide gas and the fire
had been extinguished. LUX
System had functioned promptly,
its ten 75-lb. cylinders han-
dling the fire easily."

We, in America, may also have sabotage. Are you ready for it?

Have you automatic fire protection for vital equipment? LUX Built-in Systems deliver their fire-killing charge of carbon dioxide the instant that trouble appears. Generators, oil switches, transformers, frequency changers—all of these are safer with the sure-handed, fast action of LUX fixed extinguishing systems.

Be prepared for fire — no matter how it starts ... no matter where it strikes! Get built-in LUX protection.

Walter Kidde & Company
INCORPORATED
428 West Street, Bloomfield, N. J.

brought Mr. Gherardi into the organization. In 1919 he was made chief engineer and the following year elected to a vice-presidency.

Mr. Gherardi was awarded the Edison Medal for 1932 "for his contributions to the art of telephone engineering and the development of electrical communication." He served as president of the American Institute of Electrical Engineers in 1927 and was also president of the American Standards Association and of the United Engineering Society in the course of his distinguished career.

•

▶ KENNETH C. MACLEISH, engineer with the Wisconsin Public Service Commission for the past nine years, died August 7 in a Madison hospital, where he had been confined with infantile paralysis for two weeks. He was 38 years old. Mr. MacLeish had been identified with the Wisconsin Power & Light Co. before joining the commission.

▶ HUGH C. YOUNG, president of the Wellsboro Electric Co., Wellsboro, Pa., died August 7 at his home in that town, following a brief illness. He was 75 years of age. For many years Mr. Young was superintendent of the Williamsport Street Railway Co., Williamsport, Pa.

▶ JOHN F. NOLL, superintendent of the Harrisonburg electric department, Harrisonburg, Va., died at his home in that city on June 28 in his seventy-seventh year. Mr. Noll had been identified with the municipal government for 45 years.

▶ FRANK EDWARD BOARDMAN, electrical engineer and inventor of the Boardman Electric Control for elevators, died at his home in Memphis, Tenn., July 10, at the age of 74. A native of Medina, N. Y., Mr. Boardman moved to Memphis in 1883 and with the late Gen. S. T. Carnes established the Carnes-Boardman Electric Co., there that year. Later he moved to Knoxville, where he was superintendent of the Knoxville Power & Light Co. for several years before returning to Memphis.

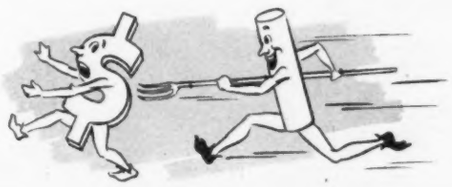
▶ JOSIAH MILTON AYER, 78, a retired electrical engineer identified with the construction of the Boston Elevated Railway, at one time connected with Day Baker in the promotion of industrial electric trucks at Boston and later associated with the wholesaling business of Talbot, Brooks & Ayer at Portland, Me., died near the last-named city on July 21. He was a native of Freedom, Me., and was graduated in electrical engineering from the University of Maine in 1886.

Just what qualities make a good duct?

The cost of any duct cannot be properly measured by so many cents per foot.

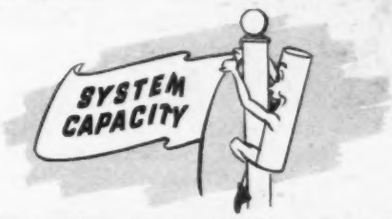
Actually, your ducts are investments — not just in cableways — but in electrical-distribution facilities. So, for an accurate accounting of the value of any duct, you must consider the effect that every section has in reducing distribution costs — at installation as well as throughout years of service.

For this reason, more and more engineers are turning to Transite Ducts. Here are the benefits that these asbestos-cement ducts provide on every job:



Low Installation Costs. Light in weight, easy to handle, Transite Ducts speed up work. Where an encasement is required, the long lengths of Transite KORDUCT cut down on spacers, mean fewer joints. Underground, Transite CONDUIT — thicker-walled, otherwise the same — is so strong it needs no protective casing. On exposed work, it eliminates screwing or threading operations. And both types of Transite Ducts have a permanently smooth bore that assures easy cable pulls . . . easy removal of cables at any time.

Low Maintenance Costs. Transite Ducts contain no metal or organic materials . . . cannot rust or rot. Underground, Transite Conduit's high corrosion-resistance assures long life. It holds its strength and true form under sustained earth loads and traffic pressure. On exposed locations, it safely withstands the destructive action of weather, smoke and fumes. And, because Transite Ducts are fireproof, they will not contribute to the formation of combustible or explosive gases.



Low Operating Costs. Made of asbestos and cement, Transite Ducts provide a high rate of heat dissipation. This results in greater system capacity, or lower cable operating temperatures that provide decreased copper losses and longer cable life. On heavily loaded cables, the savings on I^2R losses alone represent an important return on investments in Transite Korduct.

* * *

These are the qualities that make Transite Ducts a good, sound investment on any transmission or distribution system. Don't they merit a closer investigation? Write for brochure DS-410. Johns-Manville, 22 East 40th Street, New York, N. Y.

JM
Johns-Manville
TRANSITE DUCTS
Transite Conduit — for exposed locations and for installation underground without concrete encasement.
Transite Korduct — for installation in concrete. Thinner-walled, lower-priced, otherwise identical with Transite Conduit.

MANUFACTURING - MARKETS

Lets New Contracts for Parker Dam

Three contracts amounting to $150,130 have been awarded by Secretary of the Interior Harold L. Ickes for furnishing poles and insulators for Parker Dam power lines in Arizona and California.

Idaho Pole Co., Sandpoint, Idaho, will furnish 1,960 poles on its bid of $66,454, shipment to be made to Phoenix, Ariz.

Schaefer-Hitchcock Co. and B. J. Carney & Co. of Spokane, Wash., on a bid of $22,876 will furnish 786 poles, shipment to be made to Yuma, Ariz.

Corning Glass Works of Corning, N. Y., was awarded the contract for furnishing 38,000 insulators on its bid of $60,800.

The poles furnished under these contracts will vary in lengths from 45 to 75 ft. and must be either Western red cedar, Southern yellow pine, or Douglas fir. The high-voltage suspension or strain-type insulators must be of the "cap-and-pin, ball-and-socket" type of either wet-process procelain or borosilicate glass.

These poles and insulators, together with copper conductors ordered recently, are for two additional Parker Dam transmission lines, one line 110 miles long leading from Phoenix to Tucson and the other 50 miles long from Blaisdell on the Gila project in Arizona to power Drop No. 4 on the All-American Canal.

•

Westinghouse to Pay Bonus of 7 Percent

Wages and salaries of employees of Westinghouse Electric & Manufacturing Co. will be adjusted upward 7 percent this month in accordance with the wage and salary plan. The bonus for July was 9 percent.

Based on monthly earnings figures, net profit of Westinghouse for the seven months ended July 31 was $12,978,697 after taxes and charges, equal to $4.86 a share on combined 7 percent participating preferred and common stocks. This compares with net profit of $11,592,448, or $4.34 a share on combined shares in the first seven months last year.

Net profit for July was $1,410,297, compared with $1,755,436 in the same month last year and with $1,570,053 in June, 1941.

•

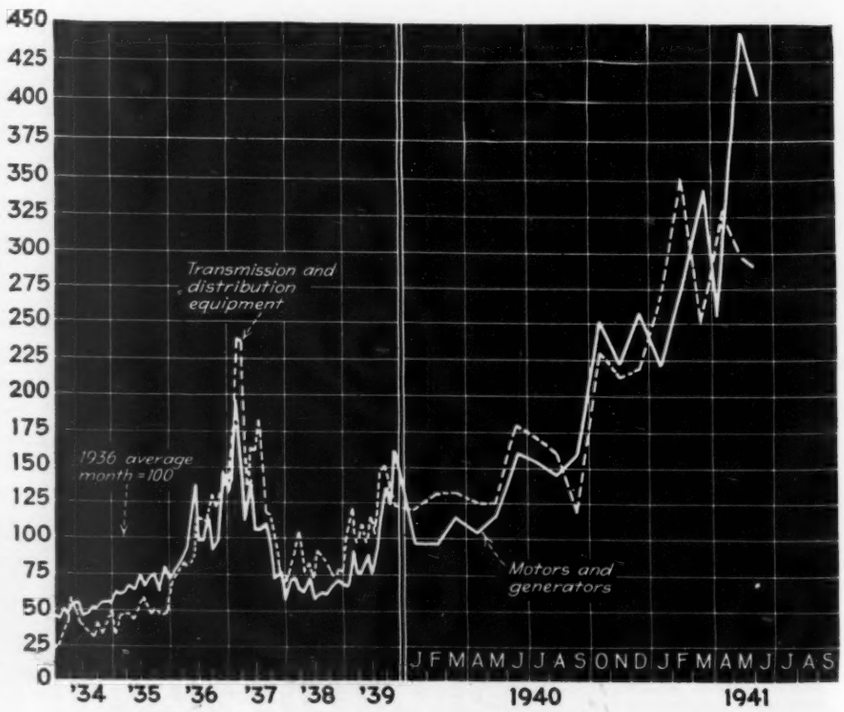
Shipments Rise 94%

Shipments of Crosley refrigerators in the first six months were 94 per cent ahead of the first half of 1940, Robert I. Petrie, vice-president in charge of sales, has announced.

Equipment Orders at Six-Month Peak

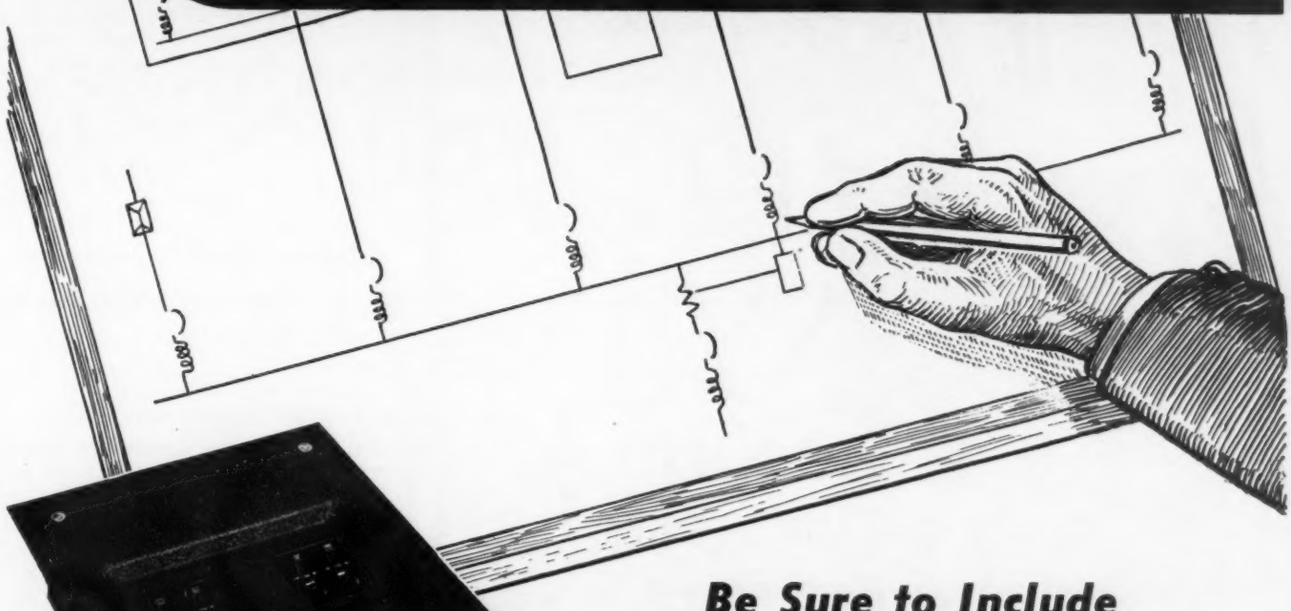
Orders received for motors and generators and for transmission and distribution equipment during the first six months of 1941 reached record highs, according to the indexes of the National Electrical Manufacturers Association.

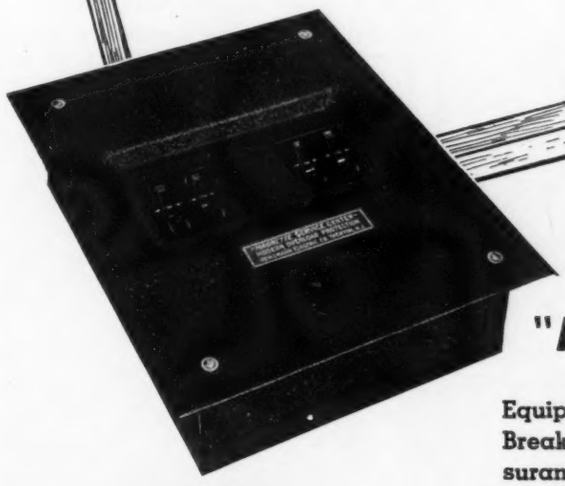
For the first half of 1941 orders received for motors and generators had an index value of 323.3, 179 percent ahead of the like period a year ago and 305 percent in advance of the first half of 1939. Orders received for transmission and distribution equipment had an index value of 299.8 for the first six months of 1941, an advance of 118 percent over the index for the first half of last year and 195



NEMA INDEX. value of orders received for motors (large d.c., polyphase, synchronous) and generators (engine, belt-driven); also for transmission and distribution equipment

For Positive CIRCUIT PROTECTION



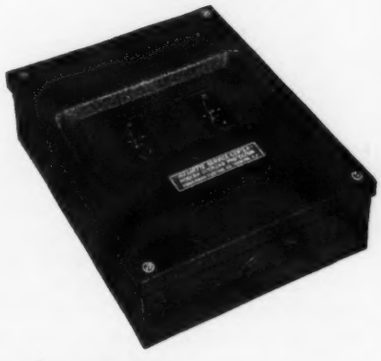


Be Sure to Include

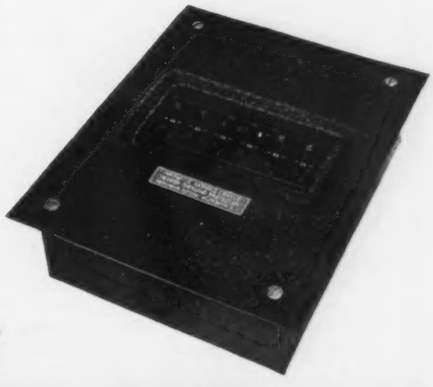
HEINEMANN

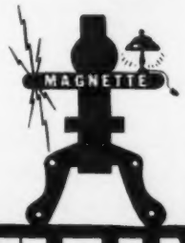
"*MAGNETTE*" SERVICE CENTERS

Equipped with Heinemann Fully Electro-Magnetic Circuit Breakers, *"MAGNETTE"* Service Centers provide maximum insurance against electrical hazards in residential wiring. They allow the passage of inrush current but trip instantly on short circuits. Regardless of the number of breakers in one enclosure they carry 100% of the rated current without opening. These breakers are also equipped with magnetic blowout contacts which quickly quench any arc.



***"MAGNETTE"* Service Centers with 2 or 4 circuits can be conveniently changed to accommodate up to 6 circuits by adding the proper breakers and bus bar connections. Covers and base plates are constructed with knockouts to simplify installation of additional circuits.**





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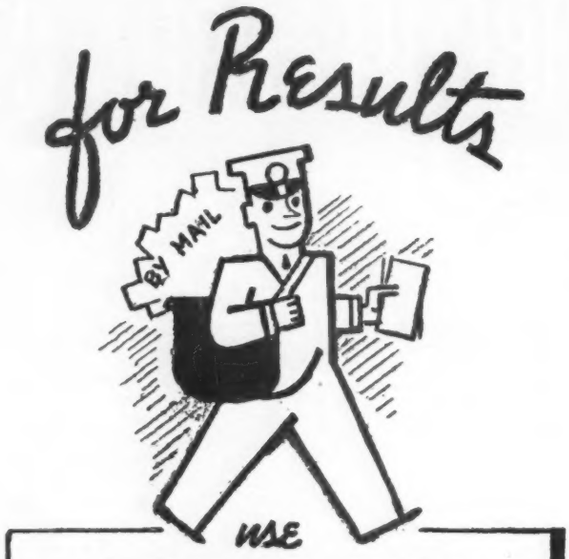

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percent above the index for the same period of 1939.

The index value of orders received for motors and generators during June dropped to 408.7 from the revised May index record of 429.7, a decrease of 4.9 percent. Orders received for transmission and distribution equipment in June continued a downward trend, going to 289.1 from the revised May index of 303.0, a drop of 4.6 percent. A year ago the first index was 160.9, while the second stood at 181.9.

•

Special Form Needed for Steel Purchase

Beginning September 1, all purchases for steel must be accompanied by a special form (PD-73) setting forth the purposes for which the ordered material will be used. This requirement, issued by OPM in putting all forms of steel under full priority control, applies to all purchasers. The necessity forms are obtainable from steel producing companies.

The new priority regulations still permit deliveries of steel to orders without defense ratings, but only after all defense orders have been filled. Steel companies also are required to accept all defense orders offered.

Utilities needing steel may order directly from producer companies, using a PD-73 form to explain the use they intend to make of the material. If the supplier cannot fill this order, application may be made to OPM's power unit on a PD-1 form for an "A" priority rating, which, when granted, a steel producer must accept and fill.

•

Recommends Priority Staff

Director of Priorities Stettinius recommends that manufacturers and producers specifically assign special members of their staffs to handle priority matters. When necessary, Mr. Stettinius said, the Priorities Division will be prepared to hold training courses in priorities matters and procedures for the benefit of specialists within homogeneous industrial groups.

New York Metal Prices

	Aug. 19, '41 Cents per Pound	Aug. 13, '41 Cents per Pound
Copper electrolytic	12.00*	12.00*
Lead, A. S. & R. Price	5.85	5.85
Antimony	14.00	14.00
Nickel, Ingot	35.00	35.00
Zinc Spots	7.64	7.64
Tin, Straits	52.00	52.00
Aluminum, 99 per cent	17.00	17.00

* Delivery Connecticut Valley.

For Vital Parts of Electrical Systems that Require Dependable Insulation

CONSULT BAKELITE PLASTICS HEADQUARTERS

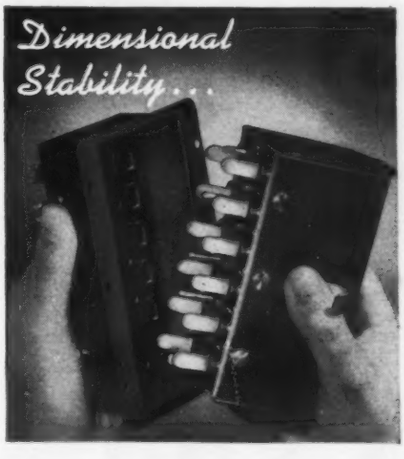
Here you will find a wide variety of plastics to choose from—Phenolics, Polystyrenes, Ureas, and Acetates. These are available in many forms—from molding materials to films.

Among these many plastics are numerous dielectric materials. One of these may have just the right combination of properties and characteristics that you require. You may be concerned with production or maintenance problems in central station operation or in the field. Our Engineering and Laboratory Advisory Service welcomes the opportunity to help you solve such problems with BAKELITE Plastics.

THE FACT that laminated plastics withstand severe mechanical shock is the reason for their use as contact stud bushings on the oil switch shown above. Replacing porcelain, these sturdy materials prevent breakage from vibration when the switch is thrown, thereby eliminating costly and time-consuming replacements. These large bushings are easily and accurately formed, requiring simple machining operations.

ONE OF THE principal requirements for cableheads used in vaults and manholes is resistance to moisture, to protect conductors against short circuits. G & W Electric Specialty Co., therefore, employs BAKELITE Phenolic Plastics for their multi-tap cableheads. These units are rapidly and securely joined to cable ends with a wrench, eliminating the taping and soldering formerly required.

FOR GREATER VISIBILITY, many instruments are now provided with translucent dials illuminated from the rear. Translucent plastic sheet stock serves ideally for this purpose. It withstands shocks and vibration, yet is extremely light in weight. It is easily fabricated with standard tools, and can be printed on or engraved. High in insulation value, it provides a "dead-front" for live circuits in back of the dial.



MOLDED POWER PLUGS and sockets, containing numerous metal inserts, require dimensional stability to prevent metal parts from working loose in service. These materials are inert to cold-flow and may be molded to exceedingly close tolerances. They assure a permanently exact fit between plug and socket as well as interchangeability of parts.

BAKELITE CORPORATION, 30 EAST 42ND STREET, NEW YORK, N.Y.

Unit of Union Carbide and Carbon Corporation

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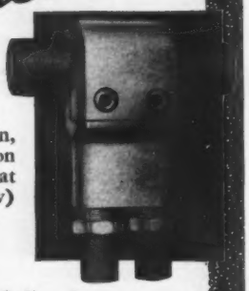
PLASTICS HEADQUARTERS

The MOST COMPLETE
LINE OF
Tee Connectors



ALL good types —any size.

With a *hinged clamp* for the main, the Penn-Union Type HFM (at right, and below) is easy to apply.

Split sleeve contact unit gives permanent grip on branch.

Made for single or multiple branch connections.

ALSO CABLE TAPS — a complete line of 90° and Parallel taps, for one or more branches.

COMPACT and POSITIVE. The Penn-Union Type SM gives equal tightening on the run and tap. Self-locking, dependable.

CLAMP TYPE TEES for all sizes of tubing and cable—a full line. Machined contact surfaces.

MANY MORE TYPES—for all combinations. For connecting flat bar, run or tap, to tubing or cable. Also "general utility" tees that take a wide range of conductor sizes. You will find that the Penn-Union line has *exactly what you need.*

FOR ANY CONDUCTOR FITTING—Terminals, Service Connectors, Studs, Two-Ways, Ground Clamps—see the THOUSANDS in the Penn-Union Catalog.

Preferred by the largest users, who have found that *Penn-Union on a fitting is the best guarantee of Dependability.*

Sold by Leading Jobbers

Write for Catalog

PENN-UNION ELECTRIC CORPORATION

ERIE, PA.

PENN-UNION
Conductor Fittings

Field Reports on Business

Orders for a wide variety of electrical equipment are still being placed by electrical utilities and by industrial firms in large volume. Electrical appliances are in great demand, with sales thus far this year running well ahead of last year.

NEW YORK

Orders for electrical equipment during the first six months this year reached an unprecedented high and sales of electrical appliances also topped records. Motors and generators have been in demand, with line equipment and other items ordered in good volume.

The current rush on major appliances, with retail sales increases now exceeding previous wholesale gains, is depleting stocks faster than had been expected. Lighting fixtures in stock are low and future deliveries are uncertain.

Utilities are buying turbines, switchgear, oil circuit breakers, transformers, lightning arresters, cable and miscellaneous equipment.

Priorities are holding up some work and hope is being expressed that a green light will soon signal speed ahead.

Price control is soon to be a major problem, with lack of goods and prospects of inflation common knowledge. Home builders are finding it difficult to secure material and prospects are that new housing will be limited to defense areas.

Engineering News-Record reports construction awards of $91,586,000, better than double the volume reported a year ago. Large utility award for the week was $2,500,000 of Kansas Gas & Electric for transmission lines.

Business in the Pittsburgh area, unchanged for three consecutive weeks, advanced to the highest level on record, according to the Bureau of Business Research, University of Pittsburgh.

NEW ENGLAND

New England industries are operating at an all-time record capacity and despite the tightening of labor and the shortages looming up in the metal markets deliveries are being carried out with surprising promptness. Small motor sales are good; line materials are less active, but inquiries for heavy switching apparatus show an encouraging trend, and slate panelboards are quoted at from two to three weeks' delivery.

New England Power Co. has purchased a 25,000-kva., three-phase, 110-kv. to 13.8-kv. G. E. transformer for installation near the Webster Street plant of the Worcester County Electric Co. A 2-mile, 110-kv., single-circuit pole line will be built between this location and the main transmission system in Auburn.

Additional large orders for forced draft fans and turbines for driving pumps to be used on new battleships and cruisers are reported by B. F. Sturtevant Co., Hyde Park. Air Corps orders placed last week among New England industries included test stands, U. S. Electrical Motors, Milford, Conn., $152,607, and motor-driven pumping units, Yale & Towne Manufacturing Co., Stamford, Conn., $41,044.

Rhode Island plans to buy lighting equipment for the state airport. Cantonment construction is advancing and a good demand for incandescent lamps and reflectors is reported. Hygrade-Sylvania Corp. reports receiving a substantial part of a U. S. government lamp contract for the year beginning next September which includes both fluorescent and incandescent lamps.

CHICAGO

Retail trade continues to widen the margin of gain over last year as sales mount higher each week. Electric appliances are very much in demand; dealers report increasing delay in securing replacements. Electric range sales in this city so far this year are 60 percent ahead of 1940. To prevent a run on the market and territorial shortages, many manufacturers had to restrict orders.

Orders for a wide variety of electrical equipment are still being placed by industrial firms in heavy volume. Increased defense orders and sub-contracts keep boosting production to new high levels. Western Electric Co. announced it had sublet contracts amounting to approximately $16,000,000. Benjamin Electric Manufacturing Co. received an order for industrial lighting equipment totaling nearly $3,000,000.

Inland Steel Co. has ordered a complete air-conditioning installation for one of its Indiana Harbor blast furnaces. Commonwealth Edison Company purchased 7½ acres costing $40,000, on which a new service building will eventually be erected. Orders were recently placed for 124,000 ft. of 5,000-volt, No. 8, rubber-insulated, lead-sheathed cable and 100,000 ft. of two-conductor, No. 17 telephone wire.

Defense contracts for electrical equipment placed here last week included: wire and cable, $125,251; ranges, $18,568; pole line hardware, $42,180; panelboards, $29,053; circuit breakers, $134,855; transformers, $26,444.

PACIFIC COAST

Pacific Coast wholesalers report steady increases of staffs, principally of warehouse and service employees, present volume being mainly due to ability to procure stock. The West has been fairly fortunate so far in this respect despite its distance from factories, because of its high proportion of defense construction. New housing projects are numerous and naturally require much inside electrical construction material, but the scale is low, as evidenced by a low electrical bid of $49,349 on a low basic bid of $1,259,852 for a 400-unit Los Angeles project. The Civil Aeronautic Authority has just made 19 allotments averaging $300,000 for California flying fields, the electrical installations of which will average $25,000 each.

The 48-hour week adopted to speed such projects as the Shasta Dam has increased sectional payrolls. Orders include $400,000 for a generating station for San Diego Gas & Electric Co., eight 12½-ton electric cranes for Ogden, Utah; two 15-ton gantry cranes for Boulder Dam.

Approximately 1,700 electric refrigerators are arriving for installation in major army camps in the 9th Corps area.

Recent Rate Changes

ARKANSAS POWER & LIGHT CO. has filed a proposed new schedule of commercial rates with the state Public Utilities Commission, putting into effect a $300,000 yearly rate reduction agreed on last May. Over-all reduction would amount to $415,000 the commission said, but this would be offset by $96,000 in new income from customers who are at present underbilled.

LOS ANGELES Board of Water and Power Commission has adopted resolutions lowering the municipal system's electric rate schedules by $980,000, as a result of recently revised Boulder Canyon project legislation and the signing of power contracts by the United States and the department of water and power. Added to the $1,044,000 reduction previously authorized by the board and pending in the city council, the total savings to consumers will amount to $2,024,000 a year. Savings to the various classes of users under the combined rate reductions are: residential, $418,000; general lighting, $938,000; general power, $466,000; street lighting, $157,000.

ILLINOIS IOWA POWER CO. recently won a decision by the state Commerce Commission when the board dismissed a complaint of the County of LaSalle against the company in which the county sought to gain for itself a rate of the company for electric service applying to cities, villages, towns, park and sanitary districts. The county's contention was that in a broad sense the county should be considered as a municipality and that it is unjust discrimination for the company to make a favorable rate applicable to municipalities, park and sanitary districts without also making it applicable to a county such as the county of LaSalle. In denying the county's petition the commission pointed out that the practice of making favorable rates to municipalities is "as old as the electric public utility industry itself" and that the courts have not held the practice unlawful in any way. Further, the commission said, to qualify for the special rate a municipality must comply with conditions which would not be present in the case of service to LaSalle County.

CHESTERTOWN ELECTRIC LIGHT & POWER CO. has filed with the Maryland Public Service Commission a schedule effecting an annual reduction of approximately $2,600 in the commercial rates of the company.

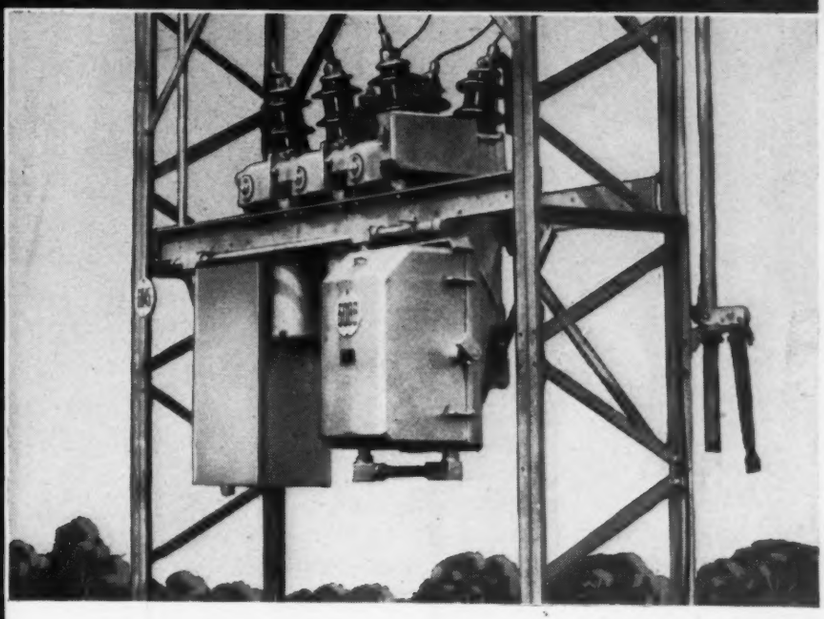
ILLINOIS COMMERCE COMMISSION has announced that rate changes effective during the month of July in that state resulted in an estimated decrease of $10,498 in annual operating revenues. Electric rate reductions amounted to $9,255, of which $5,125 is residential, $775 small power and light, and $3,355 municipal.

SPENCERPORT, N. Y., municipal electric plant residential customers will receive a rate reduction of approximately $1,800 annually. The New York Public Service Commission in announcing the reduction stated that the flat rate charge for water heaters will be cancelled. The new schedule will become effective August 30.

HAZEL GREEN, WIS., municipal utility has adopted a rate revision approved by the state Public Service Commission, which will result in a reduction of $800 annually in rates.

PLYMOUTH (WIS.) ELECTRIC AND WATER UTILITIES has put into effect a new low electric water heating rate of 1.1 cents per kilowatt-hour with a minimum charge of $1 a month for commercial as well as residential customers.

HOW TO *Modernize* EXISTING OIL CIRCUIT BREAKERS



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RPT's and RPTO's are lastingly dependable. Numerous early models dating back to 1923 are still in service.

Only small transformer capacity is required. A 200 volt-ampere potential transformer has ample capacity to operate the Recloser. Despite the low current demand, the coiled spring of the Recloser has enough stored energy to close heavy amperage, three-pole station-type breakers.

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Opening and closing motions of the main spring are cushioned. Regardless of the breaker's characteristics, the recloser operates smoothly and positively. As all hammer effect is eliminated, the RPT may be mounted on slate panel.

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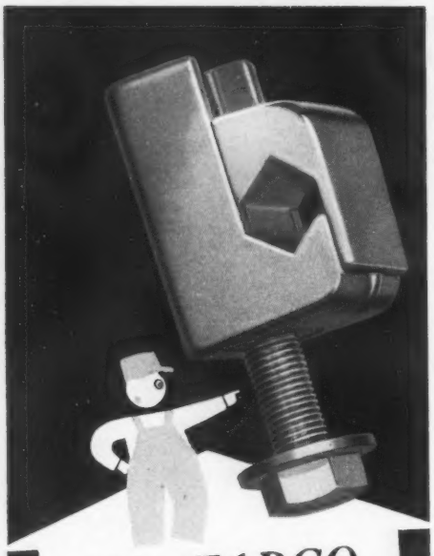

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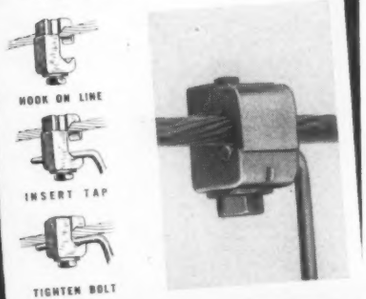

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REA Allots Funds; Contracts Awarded

Rural Electrification Administration has allotted $7,744,000 to 50 borrowers in 24 states and the Virgin Islands.

This is the initial REA loan for nine of the borrowers, which are all co-operatives; 39 have received earlier loans and will use the new allotments to expand or complete their systems, one is for additional generating facilities, and another is for the construction of small new generating plant on an island. The new loans will be used to build 8,532 miles of distribution lines to serve 21,668 farms and other rural consumers.

REA loans since it was created in 1935 now total $387,632,121.

Among the allotments are the following:

ALABAMA—Joe Wheeler Electric Membership Corp., Decatur, Lester C. Brabson, manager, $32,000 to build 35 miles of line, 156 members in Lawrence and Morgan Counties.

ARKANSAS—Riceland Electric Co-operative, Inc., Stuttgart, H. H. Harvill, president, $230,000 to build 230 miles of line, 559 members in Arkansas, Jefferson, Prairie, Monroe and Lonoke counties.

COLORADO—High Line Electric Assn., Holyoke, T. G. Puryear, supt., $777,000 to build 939 miles of line, to serve 1,549 members in Phillips, Sedgwick, Logan, Yuma and Washington counties, Colo., and Perkins, Chase, Dundy, Hitchcock, Hayes, Redwillow and Frontier counties, Neb.

GEORGIA—Central Georgia Electric Membership Corp., Jackson, G. W. Patrick, president, $183,000 to build 223 miles of line, 626 members in Spalding, Jasper, Monroe, Clayton, Bibb, Butts, Henry, Coweta, Morgan, Lamar, Fulton, Jones, Fayette and Putnam counties.

IDAHO—Northern Idaho Rural Electrical Rehabilitation Assn., Inc., Sandpoint, Glen A. Smothers, supt., $82,000 to build 78 miles of line, 220 members in Boundary and Bonner counties, Idaho, and Lincoln County, Mont.

ILLINOIS—Tri-County Electric Co-operative, Inc., Mt. Vernon, B. H. Tuttle, supt., $295,000 to build 274 miles of line, 779 members in Marion, Jefferson, Washington, St. Clair, Perry and Franklin counties.

INDIANA—Tri-County Rural Electric Membership Corp., Reelsville, Lloyd Houck, president, $175,000 to build 186 miles of line, 589 members in Putnam, Clay and Owen counties.

IOWA—D. E. K. Rural Electric Co-operative, Estherville, B. B. Shreck, supt., $115,000 to build 150 miles of line, 311 members in Dickinson, Kossuth, Emmet, Palo Alto and Clay counties.

KANSAS—Nemaha-Marshall Electric Co-operative Assn., Inc., Axtell, R. J. King, supt., $163,000 to build 229 miles of line, 517 members in Nemaha, Marshall, Riley and Pottowatomic counties.

LOUISIANA—Northeast Louisiana Power Co-operative, Inc., Winnsboro, Robert E. Holladay, Jr., supt., $75,000 to build 90 miles of line, 246 members in Morehouse, West Carroll, Richland, Franklin and Tensas Parishes.

MINNESOTA—Beltrami Electric Co-operative, Inc., Bemidji, Charles Moller, co-ordinator, $249,000 to build 329 miles of line, 777 members in Beltrami County.

MISSISSIPPI—Pearl River Valley Electric Power Assn., Columbia, C. M. Crews, supt.,

MAKE INSPECTION TIME PROTECTION TIME

The Osmoplastic Groundline Treatment will add years of service life to this pole as it has many thousand others.

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• Data sheets ready

OWENS-ILLINOIS
HEMINGRAY DIVISION, MUNCIE, INDIANA

$125,000 to build 184 miles of line, 362 members in Stone County.

MISSOURI—Cuivre River Electric Co-operative, Inc., Troy, John Schaper, president, $475,000 to build 466 miles of line, 1,142 members in Lincoln, Warren, St. Charles and Montgomery counties.

SOUTH CAROLINA—York County Electric Co-operative, Inc., York, W. B. Wilkerson, president, $147,000 to build 156 miles of line to serve 654 members in York and Chester counties. $30,000 for construction of a refrigeration locker storage plant.

Construction contracts approved between June 24 and July 24 included the following:

ARIZONA—Stonewall Electric Co., Tucson, M. A. Pooler, manager, and R. V. Sanford, Tucson Gas, Electric Light & Power Co., engineer, contract to Vancott Co., 5024 W. Washington Blvd., Los Angeles, Calif., 35 miles of line, 42 members; bid, $24,123.

ARKANSAS—North Arkansas Electric Co-operative, Inc., Viola, E. D. Chapin, manager, and Midwestern Engineering & Construction Co., 307 Drew Bldg., Tulsa, engineer, contract to the I. K. Electric Co., 311 Main St., Little Rock, 177 miles of line, 351 members; bid $127,422.

COLORADO—High Line Electric Assn., Holyoke, T. G. Puryear, supt., and Rocky Mountain Engineering Co., 1554 California St., Denver, engineer, contract to Snyder & Johnson, inc., Humboldt, Iowa, 194 miles of line, 261 members; bid, $128,161.

ILLINOIS—Clay Electric Co-operative, Inc., Flora, Michael Drazen and Associates, 4903 Delmar Boulevard, St. Louis, Mo., engineer, contract to Cater Construction Co., P.O. Box 91, Blue Springs, Mo., 289 miles of line, 605 members; bid, $203,613.

INDIANA—Wabash County REMC, Wabash, G. Gordon Downey, supt., and Bevington-Williams, Inc., 730-739 Pythian Bldg., Indianapolis, Ind., engineer, contract to Contracting and Material Co., 1235 Dodge Ave., Evanston, Ill., 36 miles of line, 103 members; bid, $26,373.

KENTUCKY—Jackson County Rural Electric Co-operative Corp., McKee, J. C. Roby, supt., and Pat M. Sullivan, Gallatin, Tenn., engineer, contract to W. A. Smith, Heyburn Bldg., Louisville, 144 miles of line, 482 members; bid, $103,007.

LOUISIANA—Claiborne Electric Co-operative, Inc., Homer, T. E. Stevenson, supt., and Ray W. Chanaberry, 1011 Realty Bldg., Louisville, Ky., engineer, contract to Delta Construction Co., Clarksdale, Miss., 122 miles of line, 290 members; bid, $69,667.

MAINE—Denny's River Electric Co-operative, Inc., Meddybemps, Ralph Hatton, supt., and J. R. Worcester & Co., 79 Milk St., Boston, Mass., engineer, contract to Miller-Baxter Co., Inc., 445 N. Pennsylvania St., Indianapolis, Ind., 98 miles of line, 260 members; bid, $89,408.

MINNESOTA—North Pine Electric Co-operative, Inc., Finlayson, Howard L. Shaw, supt., and United Engineering Service, 1406 West Lake St., Minneapolis, Minn., engineer, contract to Franzen Brothers, Palisade, Minn., 49 miles of line, 94 members; bid, $30,645.

MISSISSIPPI—Southwest Mississippi Electric Power Assn., Lorman, J. R. Miller, supt., and Bowman and Bowman, Greenwood, Miss., engineer, contract to Smith Construction Co., Box 66, Nashville, Tenn., 124 miles of line, 388 members; bid, $70,283.

MISSOURI—Black River Electric Co-operative, Ironton, Ray Brown, supt., and Frank Horton & Co., Lamar, Mo., engineer, contract to Henry Jaeger, 8532 West Schlinger Ave., West Allis, Wis., 224 miles of line, 481 members; bid, $171,986.

NEW BOOK

Electric Distribution Fundamentals

Just Out

SHOWS HOW TO SOLVE

the problems of design, construction, operation, service, methods, equipment, mechanics, and materials of electric distribution

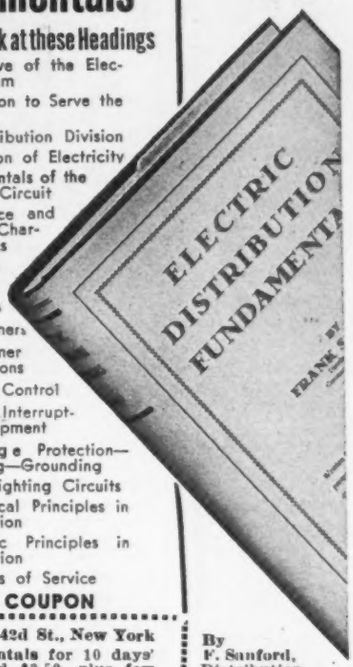
From a non-engineering viewpoint, this book outlines features of both utility distribution and the industrial and inside wiring branches of service to the outlet.

THE ABC OF ELECTRIC DISTRIBUTION

Tells how the distribution system is designed and built, how it works, and how it is serviced and operated; explains equipment and its use, design of carrying lines, problems of maintaining flow, and materials; discusses how distribution fits in economically with the general system of electric supply; covers voltage drop, wire size calculation, power factor, etc., etc. Practical design problems are included with solutions based on diagrams instead of difficult mathematics.

Look at these Headings

- Perspective of the Electric System
- Distribution to Serve the Load
- The Distribution Division
- Generation of Electricity
- Fundamentals of the Electric Circuit
- Inductance and Related Characteristics
- Tools for Electrical Problems
- Transformers
- Transformer Connections
- Voltage Control
- Current Interrupting Equipment
- Voltage Protection—Lightning—Grounding
- Street Lighting Circuits
- Mechanical Principles in Distribution
- Economic Principles in Distribution
- Measures of Service



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156 illustrations
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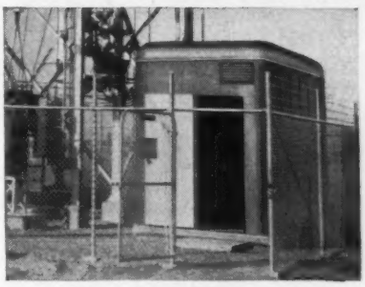
BUTLER READY-MADE STEEL BUILDINGS



Above—**BUTLER STEEL TRUCK GARAGE**—40' x 74' x 10' equipped with overhead doors. Butler round-roof buildings are available with clear spans of 100', any length—also with monitor roof.

The **BUTLER BOULEVARD BUILDING** above is 8' x 12' x 8'6" and houses **SUB-STATION** control equipment. It has double panel steel walls—Steel inside and outside—with insulation between and available in many strikingly beautiful functional designs.

The **BUTLER ALL-PURPOSE BUILDING** at right is 16' x 34' x 10' and houses **SYNCHRONOUS CONDENSER** high voltage control equipment. Ventilated for 20,000 cu. ft. air displacement per min.

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• The rubber that goes into a Miller Anode Electrician's Glove is put through its paces, and no mistake! First, for top quality, it's made from pure latex. Second, to insure smoothness, flexibility and uniform thickness and strength, it's made by the patented Anode Process. Third, each glove is minutely examined for the slightest imperfection or particle of foreign matter. Last comes the testing, with *samples* of each batch immersed in water and given an electrical charge far in excess of specifications.

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TO ATTEMPT to make the best of a relay that isn't quite what you need is truly "letting the tail wag the dog."

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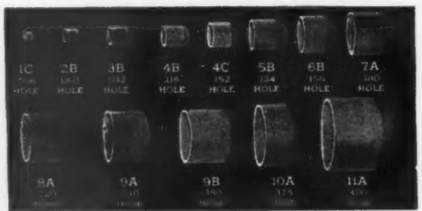

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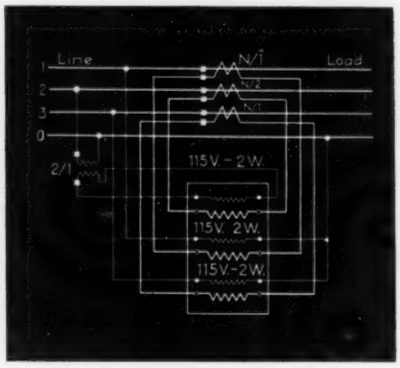
STAR PORCELAIN CO.

TRENTON, N. J.

Metering 4-Wire, 3-Phase Delta Service

[*Continued from page* 51]

ments. As the watt-hour constant for each element must be the same, the ratings of the current coils with the lower rated voltage elements are double that of the current coil of the higher voltage element. Thus, where one element is rated at 230 volts, 2.5 amp., the other elements will have 115-volt, 5-amp. rating. This meter is the same in principle as the self-contained sizes of Method III. There are objections from the testing point as explained under Method III. Special test connections and procedures are required because of the two voltage ratings. With this meter all current transformers have the same ratio, and



METHOD VII—Three-element standing Y meter transformer rated; one element has a 2 to 1 potential transformer; voltage 115; three two-wire elements have the same current rating

where the lighting load is large this may mean over-metering the third or power phase.

The above method (VII) is advised by one company where the lighting load is relatively large with respect to the power load. Here a standard three-element instrument-transformer-rated meter is used. The current transformers in the two lighting phases are of twice the ratio of that in the power phase. A 2 to 1 potential transformer is used from the power phase to neutral to supply potential to the element which receives current from the smaller ratio current transformer. This method minimizes the exent of over-metering of the power phase that would be required in previous methods. The installation cost is slightly above certain other methods of equivalent accuracy which are available. On the larger installations this increase is not serious and is offset

by the advantage of improved accuracy and the use of the standard three-element Y meter, which presents no unsual problem in calibration.

Another company has also standardized (Method VIII) on a three-element, 115-volt Y meter for such installations, connected as in Method VII except that no potential transformer is used, and all current transformers have the same ratio. The connection impresses 200 volts upon the 115-volt potential coil, but the user claims no excessive temperature rise. A special test procedure is followed. For uniformity, the meter is connected so that the lower element is always the 200-volt element. All tests are made on the separate element basis with nominal 115 volts on the upper and middle elements and 200 volts on the lower element. In the laboratory all light load adjustments are made on the lower element; in the field these are made on the upper and middle elements.

In a concluding installment will be given a summary of the methods here described, stating briefly their relative advantages, disadvantages and metering equipment cost.

•

REA Will Promote Food Preparation Program

Secretary of Agriculture Claude R. Wickard announced recently that the Rural Electrification Administration has mapped out an extensive program which will have for its objective the active promotion of community food preparation programs in rural schools and in other community centers which receive electric power from lines financed by REA. The proposed centers will enable communities served by REA systems to participate more fully in a nation-wide program for improvement of rural diets, which will be carried on simultaneously by several federal agencies. The program is an outgrowth of the National Nutrition Conference held in Washington last May.

•

City Plant Nets $21,068

The municipal power system at Tucumcari, N. M., reports a net income of $21,068 for the fiscal year ended June 30, according to C. R. Sebastian, state comptroller. The earnings were after deducting $40,625 operating expenses, $22,119 debt service and $23,456 depreciation. Gross operating revenue was $105,571.

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Sales Opportunities

MEMPHIS, TENN.—Memphis Light, Gas and Water System, Thomas H. Allen, chief engineer, plans extensions in primary and secondary lines in different parts of city, with additional service facilities. Fund of $176,120 has been arranged for work, which will be placed under way soon.

SPOKANE, WASH.—Administrator, Bonneville Project, Department of Interior, Guardian Building, Portland, Ore., plans new 115-kv. transmission line from Colfax to Spokane, about 60 miles, with power substations in both cities. Cost estimated at $856,000. Appropriation in that amount is being arranged.

MURRAY, IOWA—Town Council will have plans prepared at early date for municipal electric power plant and distribution lines. Bond issue of $90,000 has been authorized for project.

ALLENTOWN, PA.—Pennsylvania Power & Light Co., Allentown, has authorized extensions in steel tower transmission lines and will carry out work early in fall. About 500 tons of structural steel towers will be fabricated for project, and for which awards are being made.

LAS VEGAS, NEV.—Basic Refractories, Inc., Hanna Building, Cleveland, Ohio, plans installation of motor-generator sets, motors and controls, transformers and accessories, switchgear, industrial lighting system, conveyors and other equipment in new mill near Las Vegas, where site is being secured, for production of magnesium metal for Government. Plant will comprise a group of ten production units, to be constructed at successive intervals, equipped to operate under an electrolytic process, with ultimate capacity of about 11,200,000 pounds per annum. Power will be secured from Boulder Dam hydroelectric station of Government, Boulder Canyon, Nev., and transmission line will be built to plant site, where large terminal substation will be located. Entire project is estimated to cost approximately $63,000,000, and appropriation in that amount will be provided by Defense Plant Corporation, Washington, D. C., a Federal agency, which will retain title to plant.

GRAND COULEE, WASH.—Bureau of Reclamation, Denver, Colo., receives bids until September 10 for six 35,000-kva., 60-cycle, single-phase, oil-immersed, water-cooled transformers, 13,600 to 132,800/230,000 Y-volt, for units L-4 and L-5, Grand Coulee hydroelectric power plant, Grand Coulee, Columbia Basin project, Wash. Also for three similar transformers, same capacity, 13,600 to 66,400/115,000 Y-volt, for unit L-6, same power station. All equipment will be installed by Government (Specifications 983).

ALMA, GA.—Georgia Power & Light Co., Valdosta, Ga., plans new 66,000-volt transmission line from Waycross, Ga., to Alma, for connection between two power substations at respective points. Cost close to $80,000. Proposed to begin work soon.

WICKLIFFE, OHIO—Cleveland Electric Illuminating Co., Cleveland, has approved plans for immediate construction of new indoor-type power substation at Wickliffe, about 30x65 feet, for increased power supply for industrial plants and other consumers in that district. Extensions will be made in transmission lines.

VALLEJO, CALIF.—Bureau of Supplies and Accounts, Navy Department, Washington, D. C., receives bids until September 2 for quantity of electric cable for Mare Island navy yard, Vallejo, and Puget Sound yard, Bremerton, Wash. (Schedule 8357).

SANTA MONICA, CALIF.—Douglas Aircraft Co., Inc., 3000 Ocean Park Boulevard, manufacturer of large-type airplanes, plans installation of motors and controls, transformers and accessories, switchgear, fluorescent lighting system, electric hoists, conveyors and other equipment in new local plant unit for production of aircraft for Government. Cost about $522,000, with fund in that amount to be furnished by Defense Plant Agency, Washington, D. C., a Federal agency, for project.

HASTINGS, NEB.—Central Nebraska Public Power and Irrigation District, Hastings, has plans maturing for new 34.5-kv. transmission line from Johnson Canyon No. 1 hydroelectric generating station, near Lexington, Neb., to Gothenburg (Dawson County), Neb., by way of Elm Creek, for power supply in that area. Also for new 115-kv. transmission line from Johnson Canyon No. 2 hydroelectric power plant, same place, to Grand Island, Neb., where connection will be made with terminal power substation. Entire project will cost close to $1,000,000. Financing will be carried out through Federal aid.

BALTIMORE, MD.—American Hammered Piston Ring Division of Koppers Company, Bush and Hamburg Streets, manufacturer of piston rings, etc., plans installation of motors and controls, switchgear, duct lines, transformers and accessories, conveyors and other equipment in new local plant for production of aircraft engine parts for Government. Cost estimated at $1,250,000. Fund in that amount will be provided by Defense Plant Corporation, Washington, D. C., a Federal agency, for project.

REDDING, CALIF.—Bureau of Reclamation, Denver, Colo., receives bids until September 8 for one 75,000-kva., 13,800-volt, three-phase, 60-cycle, vertical-shaft, a.c., generator, for installation in Shasta hydroelectric power plant, Central Valley project, Calif., to be known as Unit No. 5 (Specifications 984). Also, until September 9, for 16 25,000-kva., 60-cycle, single-phase, oil-immersed, water-cooled transformers, 13,600 to 132,800/230,000 Y-volt; five 15,000-volt, 3200-amp., bus structures with potential transformers, current transformers, ground switches, generator lightning arresters and capacitors; and for five transformer-neutral bus structures for generating units Nos. 1 to 5, inclusive, all for same hydroelectric power station noted. All last mentioned equipment will be installed by Government (Specifications 981).

GOLDENDALE, WASH.—Klickitat County Public Power District, Goldendale, plans power substation and switching station near Centerville in connection with primary and secondary lines for new rural electric system in parts of Klickitat County, totaling about 350 miles. Cost about $450,000, and appropriation in that amount has been secured through Federal aid for entire project. Colville Engineering Co., Colville, Wash., is being engaged to make plans and surveys, subject to approval of REA, Washington, D. C.

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LETTERS TO THE EDITOR

Important—Unimportant

To the Editor of ELECTRICAL WORLD:

The commentators on your editorial of June 14 are absolutely right and I was wrong. The unabridged dictionaries do list the word "flammable."

Custom has a way of adopting the useful, and rejecting the superfluous. Lexicographers, in following custom, have presumably included in their collegiate editions of dictionaries words in general use by writers of authority. These editions include "inflammable," but exclude "flammable." Until such time as the safety code writers can influence custom, there is no help for it but that the regiment must remain out of step with Johnny. During this period of transition we shall probably have a simulation of Alice's little comedy. Remember?

Alice had just told the King of Hearts she knew nothing of the case that was being tried. "'That's very important,' the King said, turning to the jury. They were just beginning to write this down on their slates when the White Rabbit interrupted. 'Unimportant, your Majesty means of course.' 'Unimportant of course I meant,' the King hastily said, and went on to himself in an undertone, 'important—unimportant — unimportant — important,' as if he were trying which word sounded best."

CECIL W. BROWN,
New London, Conn.

[This editorial drew several replies, all in a very friendly vein of chaffing. We have enjoyed it, but especially do we wish to compliment Mr. Brown, who made the suggestion for his sportsmanship. His reply is a most amusing and fitting close to the episode.—EDITORS.]

•

The Little Red Hens

To the Editor of ELECTRICAL WORLD:

Your editorial in the issue of August 9 certainly is "different"!

I believe the little brown hen will look beyond the big ostrich egg, toward the big ostrich that regulated the size, shape and vitamin content of that egg and say "my nest eggs are good enough for me."

Although we all agree that the electric power utilities have lost much of their valuable national concentrated effort since the "good old days" of the

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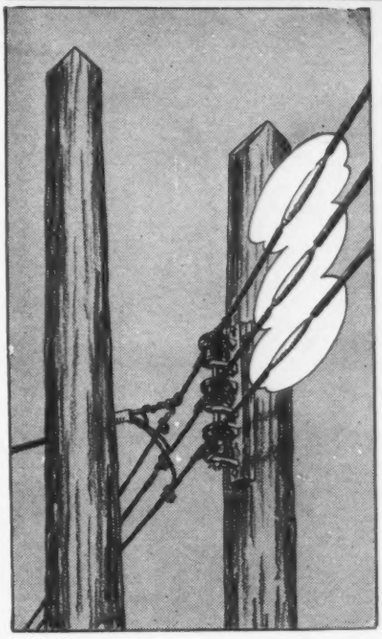

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National Electric Light Association and that the recent Edison Electric Institute convention did little to regain that desired community of interest, yet many believe that there is strength in "rugged individualism." To "go along with the pack" may be found to be the only way to get to Washington.

All the electric power utilities are doing an excellent job in preparing to meet the defense demands in their own areas. They have sufficient interests in common to provide the necessary interconnecting tie lines to supply unusual demands in any particular section of the country or in case of accidental loss of local generating capacity, without a "Federal Grid."

Paragraph 11 may show its teeth here and there with local, but temporary pain, but no single decision, cutting $14,000,000 from national gross revenue, can suddenly smash all of the big eggs as long as the little red hens set on their respective nests.

C. Francis Harding, Head
School of Electrical Engineering
Purdue University, Lafayette, Ind.

[We also like to see rugged individualism when the indiv'dual has the courage to do things. We hate regimentation as much as any man. Nevertheless, we believe that a building that has been damaged by storm can better be rebuilt by organized crews working under a set of specifications—*i.e.*, program—than by individual workmen answerable to no one.

Professor Harding may be right that no single blow can at one moment lop off millions of gross revenue if the little red hens set on their respective roosts. We submit, however, that if they continue to set at home, without cooperation sooner or later they will be plucked off one by one.—Editor.]

•

A Watt for a Watt

To the Editor of Electrical World:

I have been concerned, as have so many others, for some time by the fact that so many, I would judge by far the greatest part, of the change-overs, from incandescent to fluorescent are being made on the basis of "saving money," when there is such a tremendous opportunity to gain new and important advantages at little or no additional, long-period, costs.

However, I feel we are not getting much of anywhere. The customer, I am speaking of the small store, small office, small shop or factory owner, takes all this talk as so much ballyhoo. He knows better. If he can have more for the same price, he knows he can have the same for less. It sounds reasonable, and if something stronger than these words of ours is not used it is apt to go on for some time more.

I suggest, therefore, that it is worth while for the industry as a whole to make a real issue of the matter. Perhaps a campaign could be organized, sponsored by the Electrical World or by some group of central stations, on a "Watt for watt" basis.

The specific details of such a campaign could be worked out along many different lines, which could be adapted to the conditions and desires of the sponsoring organization. For example, each time a person could demonstrate that he had been responsible for bringing about a change-over on the basis of one watt or more of fluorescent lighting to replace one watt of incandescent a record could be made, and as the campaign progressed the total wattage recorded against each man could be published. Whenever any man reached the 50,000 watts mark he could be presented with a suitable award and be made a member of some honorary society.

What do you think of such a plan?

C. A. Atherton,
Commercial Engineering Department,
Champion Lamp Works, Lynn, Mass.

[A watt for a watt suggests an "eye for an eye" and a "tooth for a tooth." As such it hasn't much of the customer benefit angle. We are much more in favor of placing the emphasis on foot-candles.—Editor.]

•

Will Build Line Across Seneca Reservation

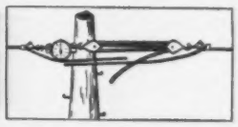
Niagara, Lockport & Ontario Power Co. has been permitted by the New York Public Service Commission to construct a high power transmission line across a part of the Cattaraugus reservation of the Seneca Nation of Indians, in Erie and Cattaraugus counties. The Seneca Nation has consented to the construction of the line under a contract which calls for payment by the company of a rental of $1 per pole per year.

The line across the reservation will be a little more than 3 miles long and will form part of a line 9½ miles long which the company plans to build for the purpose of shortening its electric transmission system to the N. J. Adam Memorial Hospital at Perrysburg, Cattaraugus County.

•

Lines Interconnected

Wisconsin Power & Light Co. and the Wisconsin Michigan Power Co. are connecting their 33,000-volt transmission lines at Clintonville, Wis.



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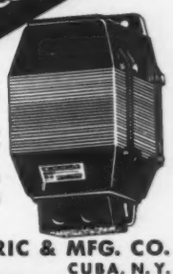

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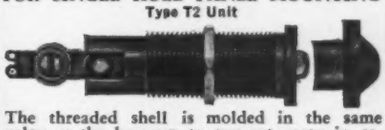

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New Defense Capacity Financing Dilemma

[*Continued from page 70*]

Corporation lease-purchase contracts are being written for facilities in competitive fields, for the most part. When it came to financing aluminum plant expansion, the government insisted upon contracts without the usual option to buy on the ground that the customary policy might ultimately strengthen an alleged monopoly. In the power field the argument is that if government is to invest money in facilities, the money should be spent in government plants.

J. A. Krug, OPM's power co-ordinator, would much prefer a minimum of government lease-purchase financing to avoid risking conflict, now or later, with public power policies. SEC looks at the matter from the investor's standpoint, contending that security holders ought not be required to help pay the carrying costs of emergency facilities from which there is little immediate value except for defense. It makes an almost perfect dilemma.

•

Toronto Hydro Reports Highest Gross in 1940

Toronto Hydro-Electric System had the highest gross revenue in its history in 1940, according to the annual report recently issued. Receipts totaled $14,023,838, or $665,284 more than in 1939. The system now has reserved and surplus of $54,341,368, while its total liabilities have been reduced to $10,360,165, the lowest since 1921.

The number of meters in use in Toronto at the end of 1940 was 198,437, compared with 195,270 at the end of 1939. Kilowatt-hours sold totaled 1,207,116,058, compared with 1,116,895,495 the previous year.

•

Sets Hearing on License for Michigan Project

Federal Power Commission has ordered that a hearing be held in Washington, D. C., on October 13 on the application for a major license by the Wisconsin Michigan Power Co. of Appleton, Wis., for its proposed storage reservoir and its proposed Peavey Falls power plant both on the Michigamme River in Iron County, Mich.

The power development will consist of a multiple-arch concrete dam 75 ft. high, a reservoir having usable capacity of about 20,000 acre-feet, a power house located about 800 ft. below the dam having installed capacity of 21,400 hp.; one transmission line extending eastward about 8 miles to Randville, Mich., and another transmission line extending southward about 3 miles to the applicant's Brule hydro-electric plant.

FPC recently ordered the company to show cause on or before August 25 why the company should not be required to make adjusting entries to bring its accounts in conformity with recommendations of FPC.

•

EHFA Closes Appliance and Wiring Contracts

Electric Home and Farm Authority has announced that contracts have been closed with Traverse City, Mich., and the North Douglas Electric Co-operative, Inc., Roseburg, Ore. A contract has also been closed with Public Utility District No. 1 of Lewis County, Chehalis, Wash. Contracts provide for co-operation in financing the sale of electric appliances.

EHFA has also recently closed a contract with the Hancock-Wood Electric Co-operative, Inc., North Baltimore, Ohio, providing for co-operation in financing the wiring or re-wiring of existing homes and farms located on the utility's power lines.

•

Order Hearing on Permit for Arizona Project

Federal Power Commission has ordered that a public hearing be held on the application of the state of Arizona for a preliminary permit for the proposed water power development of the Bridge Canyon Project on the Colorado River. The hearing will be held in Washington, D. C., on September 22.

Application for the permit was received from the state of Arizona (now represented by the Colorado River Commission of Arizona) in 1938. A request for postponement of action made a month later by a special committee representing the four upper basin states of the Colorado River was granted and subsequently representative of the seven Colorado River basin states, including Arizona, were granted additional delay. Several other delays were granted to the Comprehensive Development Committee of Fourteen of the Upper Basin, an organization which apparently succeed the Seven State Colorado Basin Committee.

Although further delays are being sought, the commission says that "no grounds have yet been stated to justify such further and continued delay in disposal of the application."

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(Continued on the opposite page)